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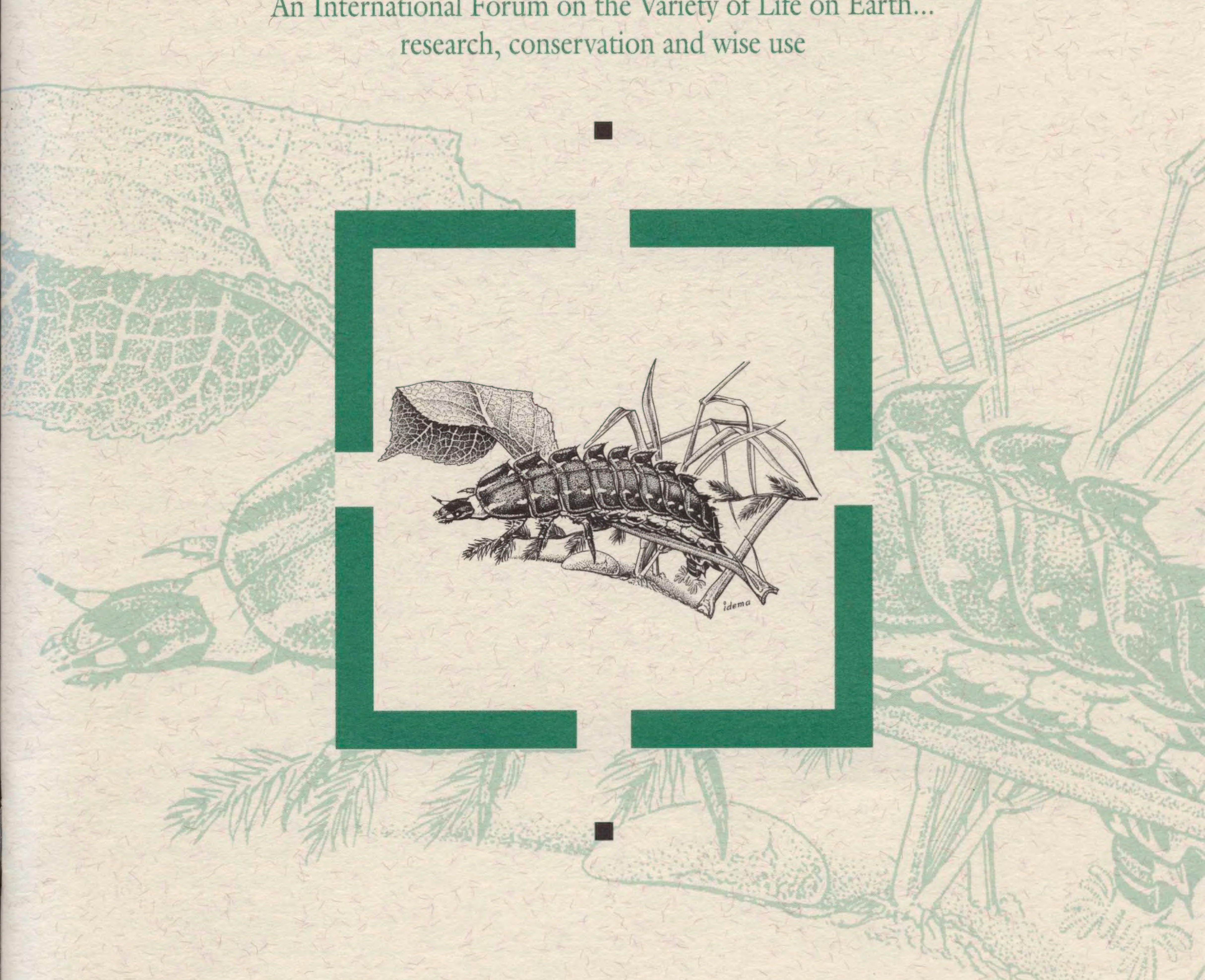
Global biodiversity

An International Forum on the Variety of Life on Earth...
research, conservation and wise use



VOLUME 3 ■ NUMBER 1 ■ SUMMER 1993

formerly Canadian Biodiversity

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Global biodiversity new name for Canadian Biodiversity

As I write this, one year has passed since the Earth Summit was signed in Rio. The United States recently became the 164th signatory of the Convention on Biological Diversity. It is increasingly hopeful that by fall of this year that 30 nations will have also ratified the Convention; 30 or more ratifiers are needed for the Convention to come into force. It is time for each state to set aside its narrow national interests and seek to share the Earth with its fellow peoples and species, all part of the family of life. In harmony with this point of view, we change the name of this bulletin from Canadian Biodiversity to Global biodiversity.

Authors from other countries are invited to share their knowledge of biodiversity, their awareness of problems and solutions, from a scientific, conservation, traditional ecological knowledge, or sustainable usage perspective.

We have changed our format from a single to a double column to make the bulletin more readable. Please let us know what you think of the new format. This first issue in Volume 3 starts with Summer instead of Spring. Subscribers, however, will receive the usual four issues.

Don E. McAllister

Don E. McAllister
Editor-in-Chief

The goals of Global biodiversity are to:

- *Publish articles, views and news on biodiversity*
- *Bridge the gaps between professional disciplines & the public*
- *Communicate information on Canadian & world biodiversity*
- *Express views on the needs & value of biodiversity research*
- *Enhance awareness of the role of biosysyematic research & museum collections to conservation & wise use of biodiversity*
- *Discuss methods and philosophy of biodiversity conservation*
- *Review books and major articles on biodiversity*

News, views, articles for publication and books or papers for review should be sent to:

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It would be helpful if longer manuscripts were submitted in Word Perfect 5.1 or ASCII format on either 3´ or 5" inch diskettes, with a hard copy printout to show italics, etc., if in ASCII.

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Cover image is the larval form of a firefly (genus *Photinus).*

Global biodiversity

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Rio Declaration

In a previous issue, Vol. 2, No. 4, the official United Nations Conference on Environment and Development (UNCED) Rio Declaration, signed by over a hundred countries at the Earth Summit, was reproduced. Below you will find the declaration prepared by non-government organizations (NGOs) at Rio de Janeiro, which were also at the Summit. You may be interested to compare the two in regards to vision and content.

NGO Rio de Janeiro Declaration

We, NGOs from the entire world, national and international networks and social movements, gathered in Rio de Janeiro at the United Nations Conference on Environment and Development and at the Global Forum, assert our commitments to the future:

1. We have become aware of the contradictions of this unjust and unsustainable dominant model of civilization, which is built on the myth of unlimited growth and which ignores the Earth's finite limits.

We understand, therefore, that the salvation of the Planet and of its present and future peoples demands the creation of a new civilization rooted in ethics that establish a basis for limits, prudence, care and respect for diversity, solidarity, justice and freedom. We emphatically stress the impossibility of attaining sustainable development unless our struggle is shared with that of societies' deprived and excluded sectors against poverty and the causes of impoverishment.

2. We strongly refuse to allow the concept of sustainable development to be simply turned into an economic notion, restricted to new technologies and subordinated to the latest market products. To allow this would be to perpetuate structural poverty and wealth that arise from the dominant model of civilization we have denounced.

To achieve sustainable societies, we affirm that the rich countries have the duty to slow, stabilize and even decrease their growth rates, so that other countries be able to exercise their right to seek and achieve dignified living conditions and civil rights for their peoples. The right of women to control their own lives must underlie any action involving population, environment and development.

3. Having demonstrated that the major responsibility for the planet's degradation and poverty lies with the majority of countries in the northern hemisphere, we also see that in the southern hemisphere governments, transnational corporations, international regulatory institutions, banks and the local elites themselves have united to reproduce the same bankrupt and unsustainable model, which is passively accepted by society.

We are aware that today's North-South relations, based on inequality, domination, exploitation and unequal confrontation, are no longer acceptable. This places before us the challenge of working together on the mechanisms that create injustice and degradation, uniting the social forces which aspire for change against those which defend the maintenance of the status quo.

4. The "Earth Summit" has frustrated the very hopes which it had raised for humanity. It has remained submissive to powerful dominant economic interests and to the prevailing logic of power. The UNCED process has shown that, notwithstanding the official rhetoric, a majority of governments were unable to hear the NGOs and, above all, to listen to the cries of the international civil society.

We must emphasize, however, that the Conference was not a total failure. Countries have displayed different positions: in many cases, citizens and public opinion have led governments to move forward. The process has also moved towards greater awareness and cohesion among all those who struggle in their own continents against poverty and for true development.

For civil society, especially, the positive side is that, after the 1992 UNCED process, it will now be impossible for governments or international institutions to decide on our future without hearing our voices. On the basis of our new awareness and autonomy, we will fight for the democratization of states, the international organizations and the UN itself. We will fight for the active participation of citizens in the various decision-making mechanisms and in control over their policies.

5. We denounce the fact that the major transnational corporations have become a power above the nations, in collusion with international public organizations, presenting themselves as champions of sustainable development. It is urgent, lest our countries' sovereign rights be attacked and the UN lose all face, that democratic controls be established over these huge corporations and the so-called free market. Only when they offer practical evidence that they have given up on the myth of unlimited growth will we be able to believe in their current alleged interest in sustainable development.

6. When we look at our societies, we see how far we have to go. Those who benefit from economic growth are reluctant to give up their consumption patterns; those who aspire to one day achieving those patterns support development at any cost; meanwhile, many cannot even express their desires, bereft as they are of even minimal living conditions.

We have discovered that a sustainable society is being built out of and in the practice of groups, communities and peoples. Part of the challenge is to value the small experiences and solutions and at the same time to promote them regionally, country-wide and even around the world.

To counterbalance proposals currently under way for integration of Southern countries through market blocs, we propose the democratic alternative of integrating their peoples in the struggle for a common future of justice and democracy.

Our goal continues to be justice in each national society and between nations. In many cities and rural areas, populations have lost their right to a healthy environment. We definitely do not want environmental exclusion to be added to the social exclusion which we have already repudiated.

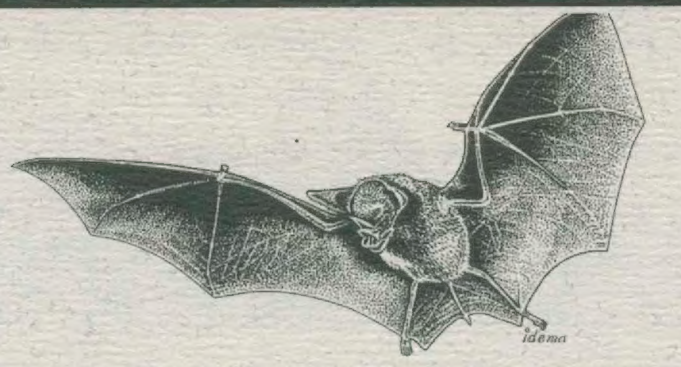
7. In a world rife with crises, in order to escape from the economic power that determines our desires and our future and from political powers that are far-off, threatening and divorced from our peoples, we are often tempted to close ourselves off into our own ethnic, cultural and religious traits. Our task is to turn this cultural, linguistic, ethnic, gender, institutional and political diversity into our very wealth.

Our greatest immediate challenge is to carry out and strengthen actions, dynamics and inter-relations that, based on our peoples' needs, progressively build common perspectives and projects. To this end, we must take a qualitative leap in leadership towards greater awareness, education, organization and inter-relation with national and international civil societies. We have no right to await the 50th Anniversary of the UN to make this project reality. Rather, 1995 should offer us the chance to evaluate all we will have done over the next three years, and be a meeting point for new challenges.

8. To speak of environment and development is to speak of life as a whole. To try to address this whole over the past several days, we have broken out a number of separate issues: climate, biodiversity, forests, savannahs, deserts and semi-arid areas, fresh water and oceans, toxic and nuclear waste, energy, fisheries, human settlements, industrial working conditions, land reform, sustainable agriculture, new technologies, communication, poverty, urban and rural violence, racism, militarism, population issues, indigenous issues, children and adolescents, women, foreign debt, international trade, transnational corporations, GATT, IMF, World Bank, global decision-making mechanisms and environmental education.

We have been moved in our debates and in the drafting of our commitments by our sense of responsibility to those who are fighting like us for a better world, and to all oppressed and abandoned peoples. We assert our commitment to struggle for them and with them. To struggle "for them and with them" equally includes defense of the environment and of nature which, like them, are used as disposable raw material. These are the commitments which we reaffirm at this starting point of the future, in this marvellous and wounded city of Rio de Janeiro, Brazil.

International Forum of NGOs and Social Movements
Rio de Janeiro, Brazil, 14 June 1992



Bat biodiversity

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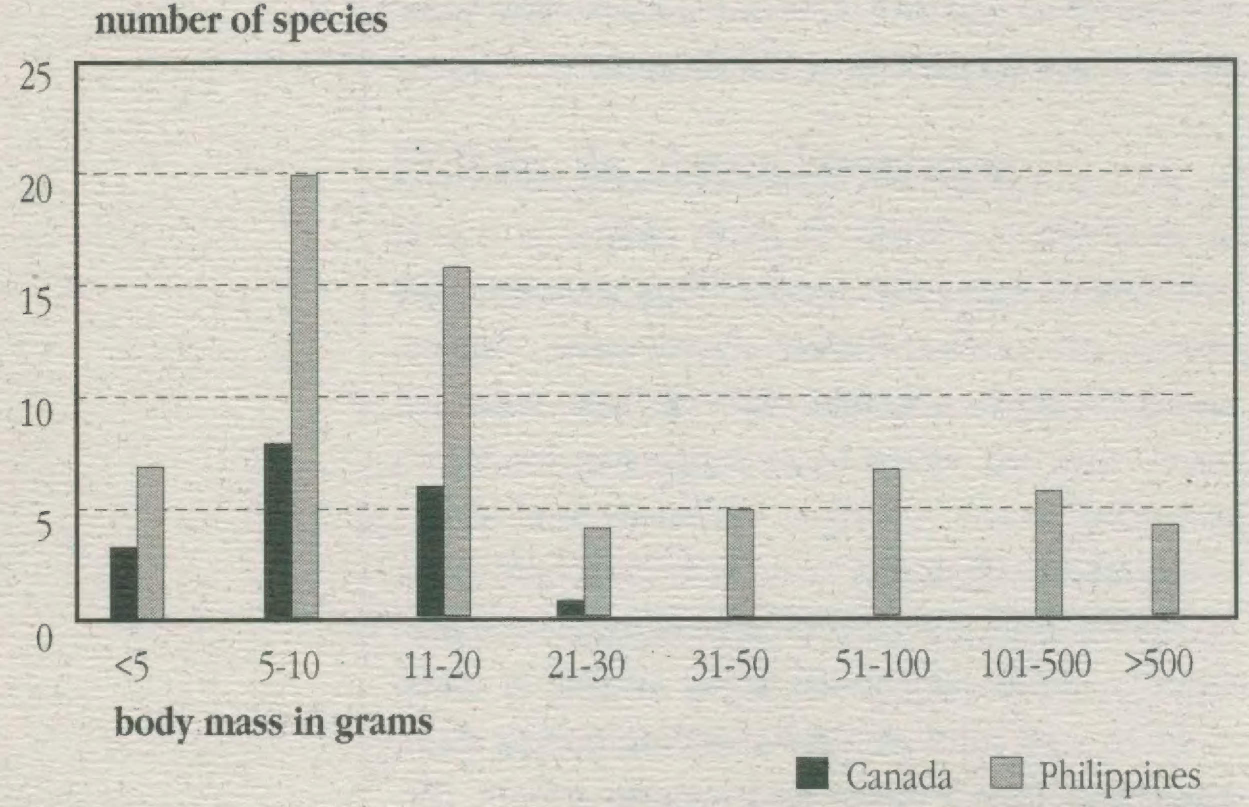


Figure 1
The frequency of different sized bats are compared between Canada and the Philippines (data from van Zyll de Jong 1985; Ingle and Heaney 1992, respectively).

INTRODUCTION

Bats make interesting topics for discussions about conservation, and here I show how bat biodiversity provides a more general model for addressing questions and issues in biodiversity. Most of the 900+ species of bats are tropical, but even in Canada there are 18 resident species. Four features of bats deserve special attention.

First, most bats are small. Their size makes them easy to overlook and thus, contributes to our lack of knowledge about them. Large Fruit Bats (*Pteropus vampyrus*), the world's largest bats, weigh 1.5 kilograms (kg) as adults, but most bats weigh less than 50 grams (g); none of the Canadian species weigh more than 35 g. Being small gives bats some protection because roosting bats are hard to find. Small size also means that although bats are bite-sized for many predators, humans usually do not use them as food or as sources of fur or teeth. Finally, their smallness in combination with high metabolic rates mean that bats have voracious appetites. The amounts of food they consume influence their role in ecosystems and their value to conservationists. Figure 1 illustrates size variations in two bat faunas.

Second, bats are long-lived. Ages of more than 10 years are probably common, and coincides with low reproductive output as most female bats give birth to a single litter each year. For most species the litter size is one or two. There are, of course, exceptions both in numbers and sizes of litters with some species having two to five litters per year. Due to their longevity and low reproductive output, bats are sensitive to a variety of environmental changes.

- *Temperate zone bats feed mainly on insects*
- *Tropical bats feed mainly on plant materials fruit, nectar, and pollen*

Third, bats fill different trophic roles in ecosystems, or in other words, bats feed on different things in different places. Temperate-dwelling bats appear to have conservative diets, feeding mainly on insects. In the tropics other bats eat plant material such as fruit or nectar and pollen, but here we are losing information on the Old World bats. Throughout the tropics, larger animal-eating bats hunt from perches and take a large array of prey such as frogs, birds, rodents, large arthropods, and even other bats. There are fish-eating bats in South and Central America, and to a lesser extent, in Africa and southern Asia. In South and Central America we find the vampire bats, three species of blood-feeders.

- *Bats moderate insect numbers, disperse seeds, and pollinate flowers*

Fourth, bats have a poor image in many human cultures. Many people think of all bats as dangerous because of the blood-feeding habits of the vampire bat. Rabies also contributes to the "bloody" image of bats. Caused by a virus and usually transmitted by bites, rabies is a disease of mammals, so it is not surprising that bats are susceptible. Like any other untreated rabid mammal, a bat may bite and transmit rabies virus before it dies from the disease. Although we do not fully understand the role of bats in the epidemiology of rabies, we know that bats are not symptom-free carriers of the disease. Unfortunately, this fact has not fully penetrated the public domain, let alone the offices of medical authorities.

BATS AS MONITORS

Bats offer a valuable window on the health of ecosystems because of their combination of size, longevity, and trophic diversity. We know that in tropical settings, fruit bats are important agents of seed dispersal and of pollination. Insectivorous bats, on the other hand, may provide biologists with ways of documenting levels of insecticides in the environment by their droppings,. Through habitat preferences, other species may offer a convenient way to keep track of changes in ecosystems.

With about 900 species, some bats will be more valuable as monitors than others. For example, even with today's technology, the smallest transmitters allow us to use telemetry to study only bats weighing more than 15g. Telemetry is an excellent way to document patterns of habitat use, letting the bats to reveal how they view their surroundings. Since the taxonomy of some bats is controversial, and a few species are hard to identify, the practical value of these bats as tools for conservation is limited.

THE SURVIVAL OF BATS

Some islands in the South Pacific harbour ENDEMIC* species of flying foxes, a type of bat. In areas like Guam in the Mariana Islands, there is a long standing local tradition of harvesting flying foxes as food for festive occasions. Using nooses on the ends of long poles, people caught roosting bats for their tables. Until firearms became widely available to the islanders, the rate at which they harvested the bats was less than the bats' rates of reproduction. But the demand for flying foxes as food has grown in some parts of the South Pacific, and this market, combined with the relative ease with which the bats are killed by shooting, has led to the extermination of some species and the decimation of others.

- *The main threats to bats are habitat disturbance & destruction*

The main threat to the survival of most bat species, however, is habitat disturbance and destruction. Although some bats adjust to human-modified environments, many others probably do not. In southwestern Ontario, for example, the Big Brown Bat (*Eptesicus fuscus*) is a common species that is active in urban areas, while Red Bats and Hoary Bats (*Lasiurus cinereus*) are also common but more restricted to less developed areas. Meanwhile, in the Yucatan Peninsula in Mexico, the Common Vampire Bat (*Desmodus rotundus*) is more common in areas developed for pasture, while other species occur only in undisturbed settings. Presumably, many species of bats are adversely affected by the destruction of rain forests.

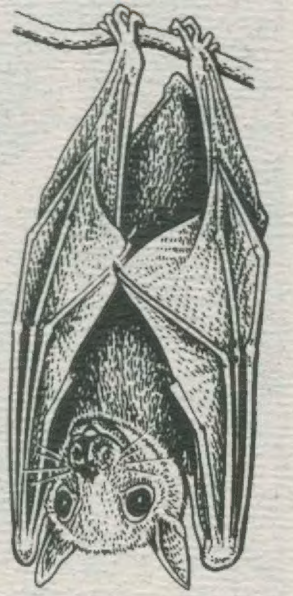
Habitats provide bats with two essential resources, namely roosts and food. For most bats, we have no details about either. For example, eight species of bats regularly occur in Ontario. All are insectivorous, and two, Red Bats and Hoary Bats, commonly roost in foliage. Two others, Big Brown Bats and Little Brown Bats (*Myotis lucifugus*), often roost in buildings, but we can only guess about the day roosts of the other four. Our knowledge about the details of any of these species' diets is rudimentary.

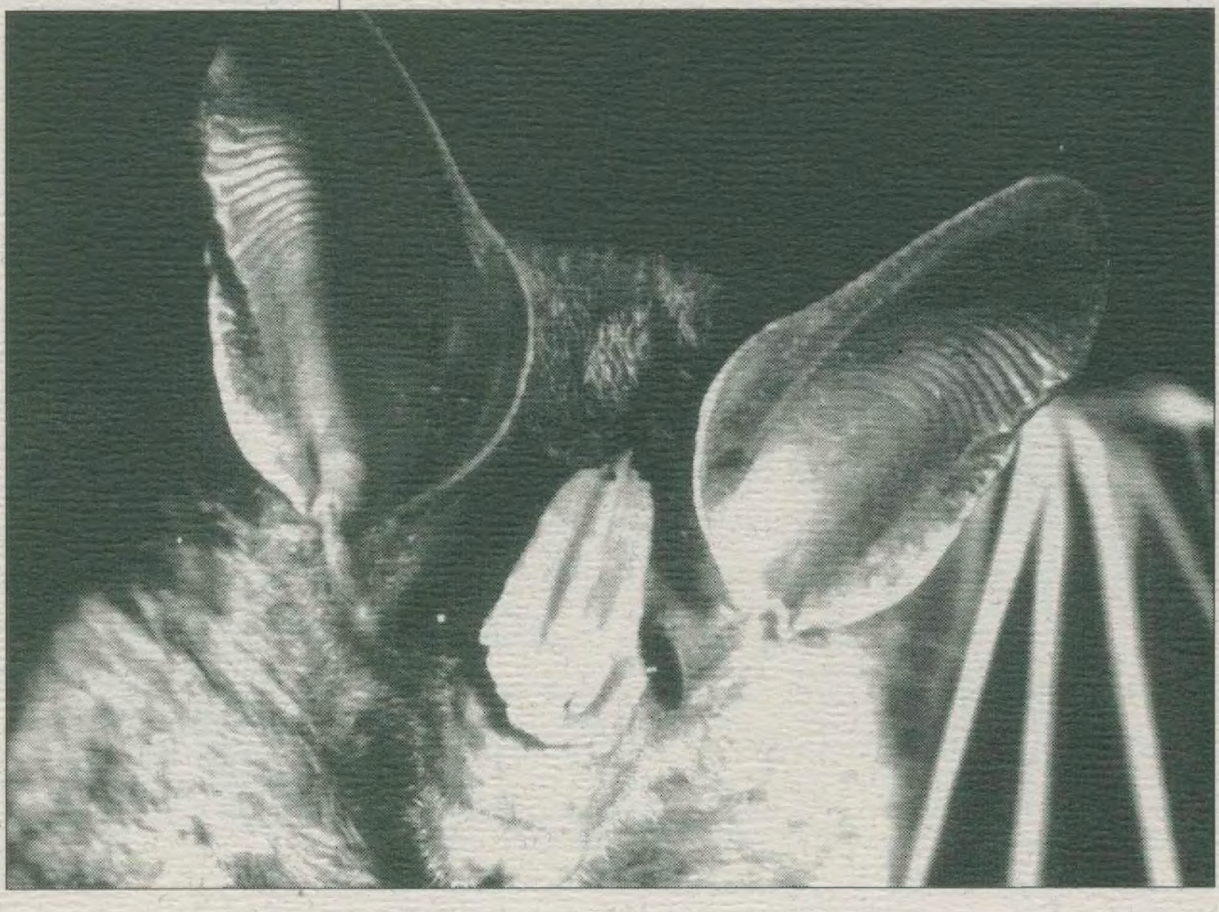
PUBLIC PERCEPTIONS

Fear is one reason that many people do not want bats in their buildings. There is a common view that bats are dangerous because of rabies and their droppings. While bat droppings sometimes harbour the spores of a fungus *Histoplasma capsulatum*, in tropical, subtropical, and warm temperate areas, this is not true in Canada. In humans this fungus can cause histoplasmosis, a disease of the lungs that, in Canada, is typically associated with chicken and pigeon droppings. In Canada, house bats constitute a nuisance rather than a danger. Their droppings are messy but do not harbour histoplasmosis. People, however, are often intolerant of nuisances and there is a good deal of interest in ways to control bats.

Sealing bat entry routes into buildings is the only effective way to control bats. Bats have neither the claws nor the teeth to create or modify their access routes into buildings, so "evicting" bats can be easy.

*ENDEMIC: *means the natural range of a species limited to a given region (small or large).*





Two neotropical bats, the Least Sac-winged Bat (*Balantiopteryx plicata;* Emballonuridae) above and the Wooly False Vampire Bat (*Chrotopterus auritus;* Phyllostomatidae) below illustrate the variety of bat faces. Least Sac-winged Bats weigh 6-7 g. and hunt flying insects. They commonly roost around buildings, usually hanging on the walls in alcoves and foyers. Wooly False Vampire Bats are much bigger (70-90 g.) and often take their prey from the ground, meaning that they eat small vertebrates as well as large arthropods. These bats are usually encountered in undisturbed forest.

What implications does this roost sealing have for bat conservation?

When evicted from their preferred roosts, we know that Big Brown Bats (equipped with radio-transmitters) moved to nearby buildings In urban areas, this usually meant going <100 meters (m), in more rural areas, 500 m. Big Brown Bats then produced fewer young in their alternate roosts than they did in their preferred ones. Little Brown Bats are different. They are too small to carry radio-transmitters, so movement patterns are documented by recaptures. At Chautauqua, New York, a five-year study involving the banding of over 8,000 Little Brown Bats showed that these bats disappeared from the population when evicted. All but 1% of 545 bats caught and banded in buildings, which were then sealed, have disappeared from Chautauqua. Normally, we recapture 20% of our banded animals.

▪ *Biologists must renew their efforts to increase tolerance of bats.*

Although bat control by eviction is better than lethal alternatives, the fidelity of Little Brown Bats to particular sites may make exclusion deadly.

In other parts of the world, notably the United Kingdom, it is unlawful to bother bats in their roosts. This position is not unanimously acclaimed, and today some people in the U.K. want churches to be exempted from the bat protection laws so that fewer bats will disturb services. Many people point out that protecting bats in their native settings is one thing ... it is quite another in buildings.

BATS AND DIVERSITY

Bats and their conservation reflect the spectrum of issues and problems encountered in the conservation of any other animals. They present the same crisis related to human harvesting that confronts rhinos and also challenge our attitudes toward organisms that share our dwellings and other buildings and do no harm. For most bats, however, our ignorance makes it difficult to identify specific steps to conserve them...if not impossible. Bats also epitomize the difficult problem of human perception. Bats are not big and charismatic, and unfortunately, most people do not worry about their future.

FURTHER READING

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Help bat conservation. See page 48 for plans for building a bat house.

Biodiversity and conservation in Guyana:

A new centre for the study of biodiversity

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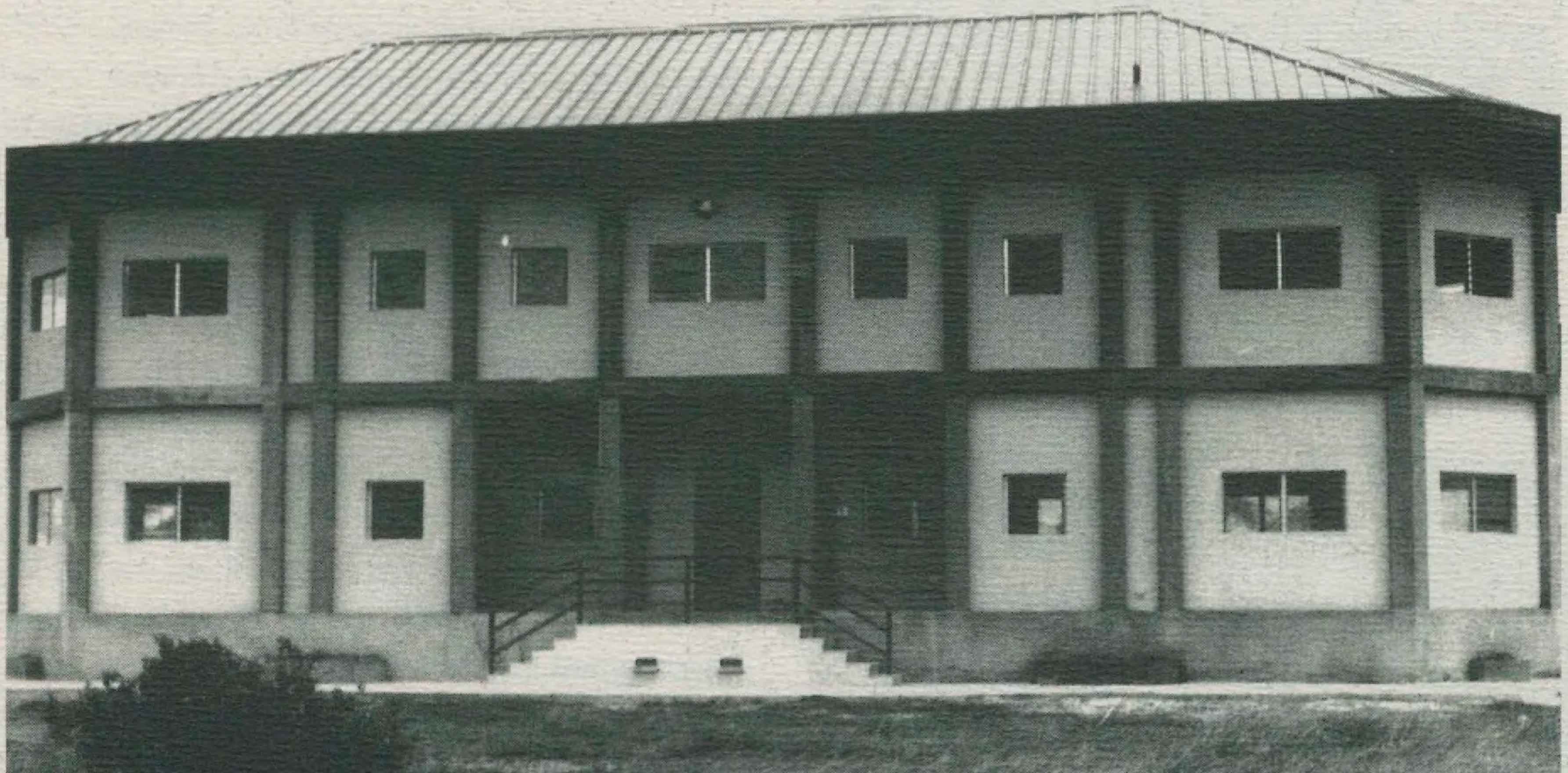
INTRODUCTION - THE CENTRE

In June 1992 a new Centre for the Study of Biodiversity opened in Guyana. This is the first biodiversity centre in South America and was the result of several years of negotiations and planning by the Smithsonian Institution's Biological Diversity of the Guianas Program, the University of Guyana, and the World Wildlife Fund, with funds donated by the Royal Bank of Canada. The Centre is dedicated to the study, documentation, and conservation of nature. It is housed in a new two-story building on the grounds of the University of Guyana in Georgetown, the capital city.

The Centre's programs are currently under development but plans call for the establishment of three committees, one each for science, education, and conservation. The overall steering committee will consist of the University of Guyana, the World Wildlife Fund, and the Smithsonian Institution. The Centre will house scientific collections including the Guyana National Herbarium and the University zoological collection, and it will contain the necessary research facilities to study these collections. An active plant-collecting and inventory program is already underway at the Centre. The goal of the conservation committee is to find ways to use the biological information to further conservation efforts. The education committee will work to improve the teaching of natural history in primary and secondary schools and to increase awareness of biodiversity and conservation issues at the university level. The Centre has been planned to serve as a training and resource site for Guyanese students.



Photograph of the Centre for the Study of Biodiversity in Guyana, funded by the Royal Bank of Canada.

(Photo by Sally Sprague (c))

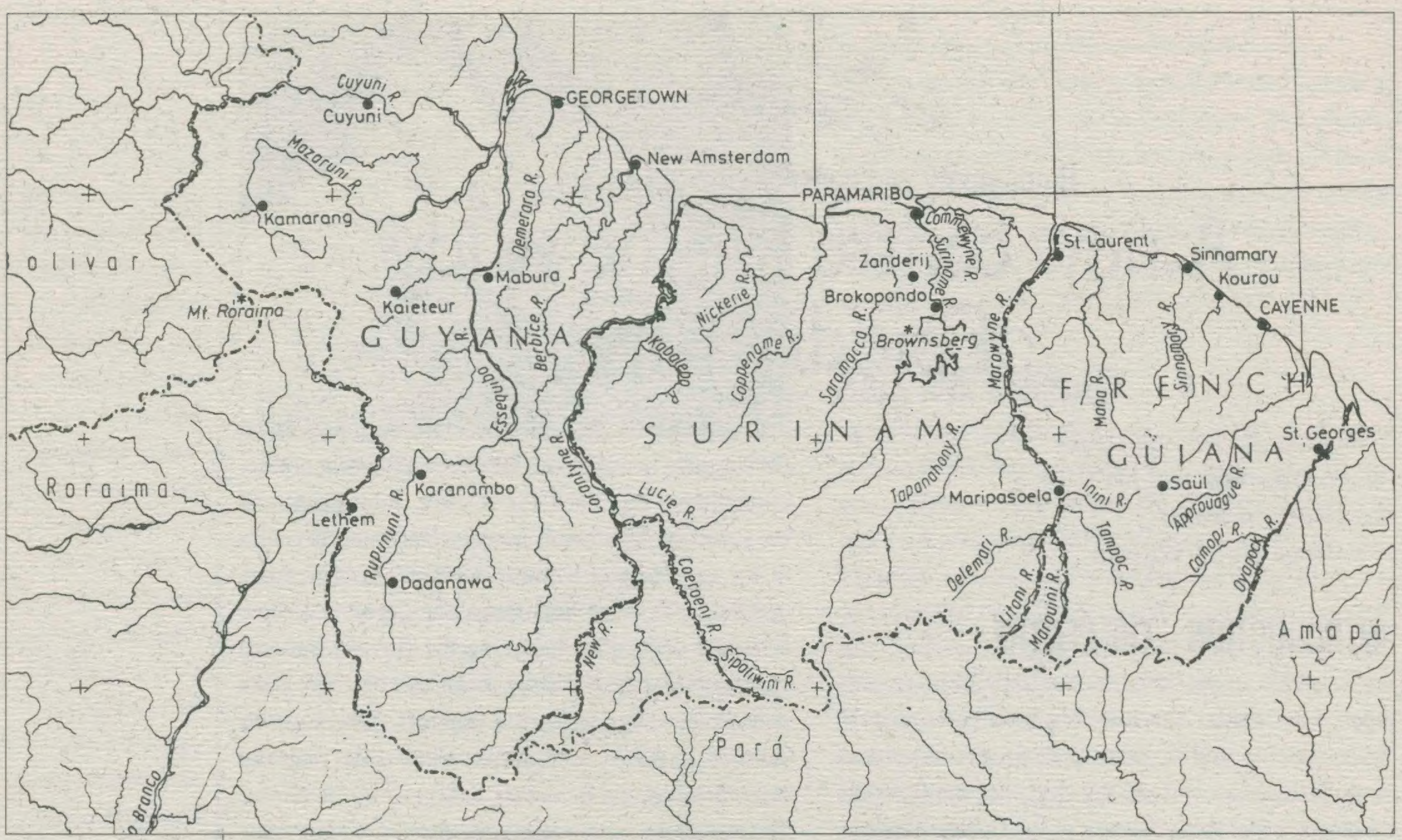


Figure 1: Guyana lies just north of the equator on the northeastern shoulder of South America

GUYANA - BACKGROUND INFORMATION

Guyana lies on the northeastern shoulder of South America, just north of the equator between approximately 2° and 8° of latitude. (See Figure 1.) The country is 231,800 square kilometres in area, and it is bounded by the Atlantic Ocean to the north, Venezuela to the west, Brazil to the south, and Surinam to the east. Guyana, formerly a British colony (British Guiana), attained independence in 1965 and is the only English-speaking country of South America.

Fig. 2. The Rupununi Savannas and the Kanuku Mountains during the rainy season.

Geology.

Guyana sits on an ancient granitic Precambrian shield: the Kanuku Mountains in south-west Guyana are the largest granitic outcrop in the country. The base rock is overlain in some areas by a very thick layer of sediments belonging to the Precambrian Roraima Formation. These sediments, predominantly sandstone, are from the Pakaraima Mountains of west-central Guyana. The mountains are bordered on the north and east by a steep, rugged escarpment and culminate in Mt. Roraima, a 2,772 meter (m) peak on the Guyana-Brazil-Venezuela border. Roraima is a spectacular, steep-sided, table mountain or tepui (tepui is the Pémun Amerindian name for table mountains), and is purportedly the site of the fictional "Lost World" (Doyle, 1981).

Phytogeographic unit - plant zone.

The Guayana Highland region, consisting of the sandstone highland areas and tepuis of Guyana and southern Venezuela, has long been recognized as a unique floristic unit, based on an unusual and highly endemic flora (Maguire, 1970; note that the term "Guayana" was introduced to distinguish this region from the country Guyana). Recently, a much larger Guayana Lowland Floristic Province (called here the Guayana Region) has been outlined to include both the highland areas and the associated drainage basins of the lowland (Mori, 1991). This region is bounded on the south by the Amazon River, and on the west by the Orinoco and Negro Rivers. It includes the three Guianan countries, the Venezuelan Guayana, and parts of the northern Amazonian Brazil.

WHAT DO WE KNOW ABOUT BIODIVERSITY IN GUYANA?

Habitat diversity.

Guyana is a mosaic of many different types of forest and savanna, which are a reflection of the diversity of soil types, underlying bedrock, and topography. Mangrove and swamp forest grow on the rich alluvial coastal soils. The white sand of ancient beaches support a patchwork of savanna and dry evergreen forest. Further inland is a vast expanse of rain forest, seemingly uniform but actually variable in composition. This lowland rainforest is interrupted in the southwest by the Rupununi Savannas and the granite outcrops of the Kanuku Mts. To the west, montane forest and upland savannas cover the Pakaraima Mts. While the lowland savannas are grass dominated, many of the upland savannas are dominated by bromeliads, sedges, Xyridaceae (yellow-eyed grasses), and Rapateaceae (an unusual monocot family reaching its greatest diversity in the Guayana Highlands, where about 90% of its species occur), forming a vegetation type unique to the Guayana Highlands.

Plant or Floristic diversity.

In a preliminary checklist, 6,500 species of vascular plants are recorded from Guyana (Boggan et al., 1992). The largest flowering plant families are the Fabaceae (legumes), Orchidaceae (orchids), Rubiaceae (coffee family), and Poaceae (grasses). The total numbers of species is most likely an underestimate since Guyana has not been thoroughly explored botanically. The degree of endemicity, or the proportion of native species restricted to the region, is known only for a few families: 32% of the Lecythidaceae (Brazil nut family) and Chrysobalanceae (cocoplum family) are endemic (Mori, 1991), and 8% of Euphorbiaceae (spurge family) are endemic (Gillespie, 1993). Less than 3% of Poaceae (grasses) (Judziewicz, 1991) are endemic to the Guianas, even fewer to Guyana. Endemicity is, of course, much higher for the more phytogeographically natural Guayana Region. For example, an estimated 45% of Euphorbiaceae (spurge family) in the Guayana Region are endemic. Probably the most important plant species endemic to Guyana is greenheart of the Lauraceae or Laurel family. Although the laurel is Guyana's most important timber tree, its unusual flowers were correctly described only recently. The result is that the species now forms the basis of a distinct new genus, Chlorocardium.

Animal or Faunal diversity.

Only very preliminary lists of some of the animal groups exist for Guyana. Collections at the U.S. National Museum of Natural History include 22 species of lizards, 97 species of mammals, and 80 species of termites. Snyder (1966) list 720 species of birds in Guyana. While no bird species is endemic to Guyana, about 40 species are restricted to the Guayana Region. One of the more unusual ones is the Guianan Cock-of-the-Rock.

Fig. 3.
A rare Passiflora vine.

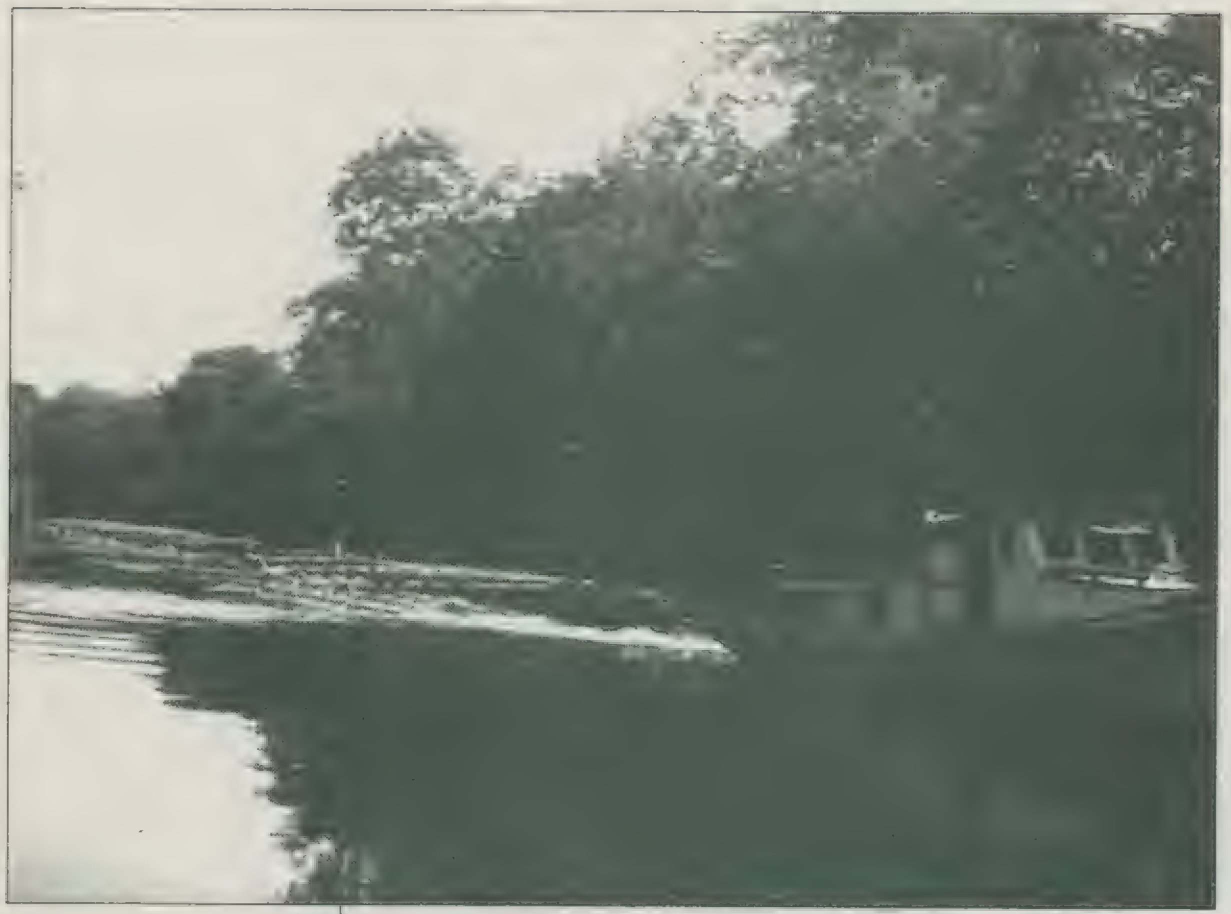


Fig. 4.
A logging boat transporting logs from the Canje headwaters to the coast.

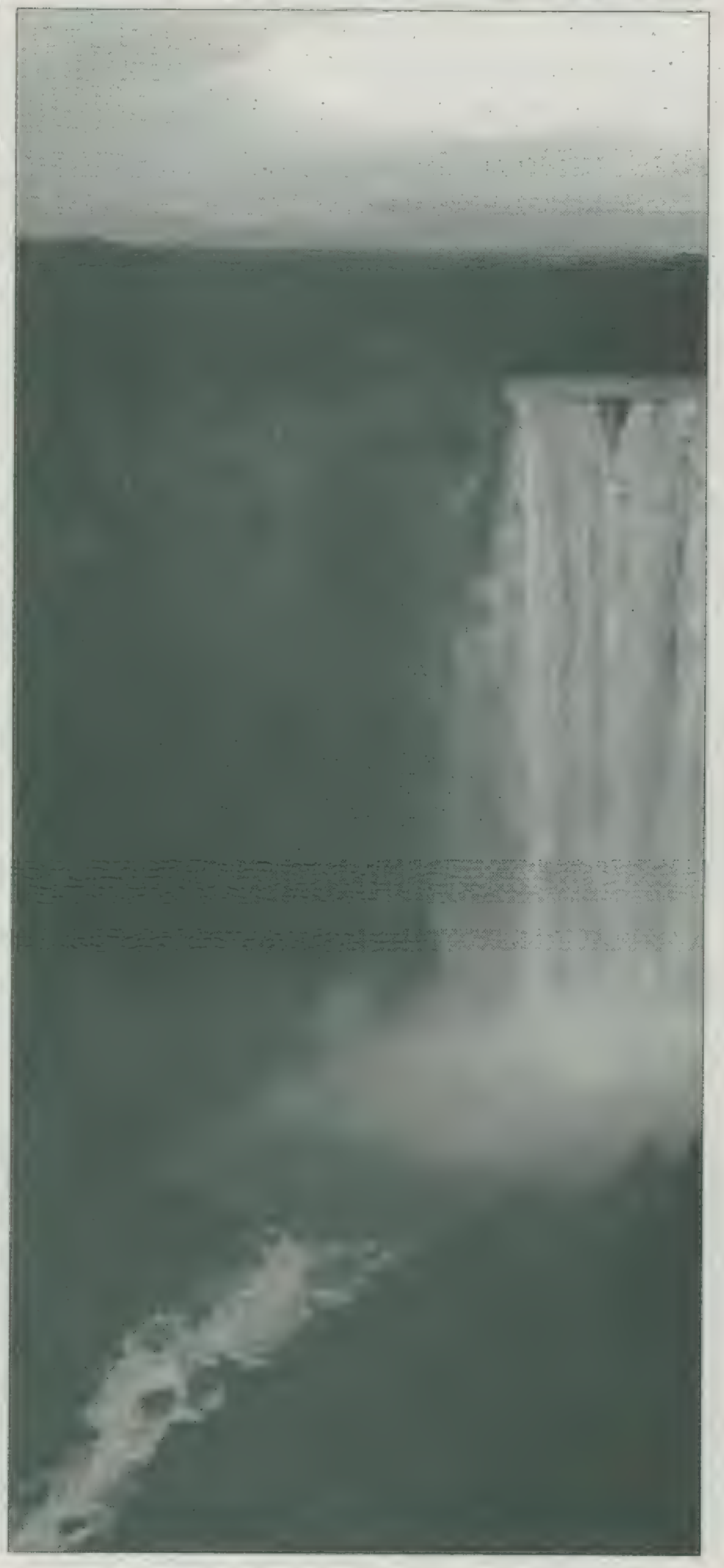


Fig. 5.
Kaieteur Falls, the focal point of Guyana's only national park.

HUMAN IMPACT

Past impact.

While parts of Guyana have been seriously impacted by human activity, much of the natural vegetation is relatively untouched. The population is about 750,000, giving a density of approximately 3.5 inhabitants per square kilometre, the third lowest in South America (following French Guiana and Surinam). The population is unevenly distributed with the majority confined to a 5 to 20 kilometer (km) wide fertile coastal strip between the Pomeroon River and the Surinam border. Here the coastal mangrove and swamp forests have been drained and largely replaced with fields of rice and sugar cane. (Demerara sugar is named after the river and adjacent coastal area of that name.)

While most of the interior forests remain, there has been some impact by small-scale lumber and mining operations. Much of the forest, accessible to the coast by river or road, appears to have been selectively logged, particularily for greenheart. There are several large and locally destructive open pit bauxite mines, such as the mine near Linden, south of Georgetown. Dredging for gold and diamonds has had a negative impact on fresh water ecosystems, as it causes mercury pollution, bank erosion, and heavily silted waters.

In contrast, the lowland savannas are more heavily impacted, particularly by cattle grazing and the practice of annual burning. While appearing fairly "natural," the composition of the vegetation has undergone major changes as a result of thousands of years of man-induced fires. Although it is not known for certain, the interior lowland savannas originally may have dominated by sedges rather than grass, as is still the case in the few remaining undisturbed savannas in the upper Rio Negro region of Venezuela.

Future problems.

Overpopulation and the resulting human pressure to cut tropical forests for agricultural use is not a major problem in Guyana, as it is in much of the Amazon Basin. With immigration exceeding population growth, the population has actually decreased in the last 10 years. Coastal land, containing the richest soil in Guyana, is underutilized as much previously cultivated land now lies fallow. In contrast, the major future threats to the forest ecosystems are the large-scale, multinational lumber and mining operations and increased gold and diamond dredging. Recently, large timber concessions have been given out, and depending on the speed of operation, Guyana's mature forests could be drastically reduced in area in under 20 years. In addition, recent innovations in gold dredging (specifically missile dredges that operate like enormous vacuum cleaners sucking up large quantities of sediment from river beds and banks) have greatly increased the potential for water pollution and river bank erosion, a serious problem to fresh water ecosystems and interior Amerindian settlements. New roads to the interior will improve access and undoubtedly hasten "development." In 1991, a large area of lowland rainforest was opened up with the completion in 1991 of a dry season road (following an old cattle trail) linking the Rupununi Savannas and adjacent Brazil with the coast. Also, increased access to rainforest will likely facilitate the illegal trade in wildlife. An active trade, both legal and illegal, has already substantially decreased some bird populations in Guyana.

CONSERVATION IN GUYANA

Kaieteur National Park was established in 1973 and has, as its focal point, the spectacular Kaieteur Falls. The falls cascade over a sandstone escarpment, dropping 232 m down into the Potaro River. Currently the park includes only the falls and the land immediately surrounding it and is about 1 km² in area. Planning for expansion with a management plan has been proposed (Schuerholz, 1991), but has not yet been agreed upon by the government. The expanded park, an area of 4,000 to 4,500 km² including Mt. Ayanganna, the second highest peak in Guyana, would consist of a biological reserve, a tourism zone, and an area for traditional use by Amerindians. To date, Kaieteur National Park remains the only national park and the only legally protected biological area in Guyana.

A Commonwealth Conservation Area is in the initial stages of development. The 3,650 km² area would be located along the new section of road just north-east of the Rupununi Savannas. Over one half of the land would be open to mining and 'sustainable' forest exploitation, with the remainder set aside for ecotourism and scientific research.

In addition to the Centre, there are several other conservation and biodiversity programs in Guyana. The Smithsonian Institution's Man and the Biosphere Biological Diversity Program is currently setting up permanent inventory plots as part of its biodiversity monitoring program. Conservation International has recently established a Guianas Regional Program to assist in conservation matters and to promote ethnobotanical research in both Guyana and Surinam. The Amerindian Research Unit at the University of Guyana is an active research unit specializing in Amerindian Studies. It will be necessary to ensure participation of indigenous peoples in issues affecting their land and future.

SUMMARY

There is an urgent need for the establishment of a system of national parks and reserves in Guyana. For the moment its diverse fauna and flora is relatively untouched, but Guyana has the potential to be 'developed' rapidly at the expense of its forest and savanna ecosystems. It is essential that land be set aside for parks and reserves as soon as possible before all is claimed for other purposes.

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Zoological gardens and biodiversity:

From exhibition of animals to environmental action.

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From the earliest of times, the existence of zoological gardens can be attributed to the desire to collect the strangest animals and keep them in captivity. Both ancient menageries and the most modern bioparks and biodomes satisfy the curiosity of the public and impress them by giving proof in some fashion of the diversity of the animal kingdom.

But faced with the pressures of the modern world, that biodiversity is crumbling away at an alarming rate. In bygone days, zoological gardens were mere windows on the animal kingdom. Now they devote themselves almost exclusively to the conservation of the most rare species and to raising public awareness about the need to protect species habitats. The desire to be useful and to become essential in the environmental debate encourages more and more zoological gardens to abandon their humble role of producer in order to take on the role of passionate actor on the stage of nature conservation.

A few months after the World Conservation Union (IUCN), the World Wildlife Fund (WWF), and the United Nations Environment Program (UNEP) published the World Conservation Strategy in 1981, the American Association of Zoological Parks and Aquariums launched the Species Survival Plan, an ambitious cooperative programme of breeding that is aimed at insuring the survival of endangered species. Today, that program covers about 60 species; in 1995, it should include about 100 species, and by the year 2000, more than 200. Based on the American experience, similar programs have subsequently been put together in Europe, and more recently, in Japan (Prescott, 1991).

At the same time, the International Association of Zoo Educators adopted the objectives of the World Conservation Strategy (Kirchshofer, 1982). From then on, the educational efforts made by zoological gardens focused on the protection of nature and the conservation of biological diversity.

These commitments prompted zoological gardens to embark with newly found energy on the road to sustainable development. I intend to illustrate with concrete examples how our zoos can help improve the relationship between humans and nature.

THE CONSERVATION OF ANIMAL SPECIES

More than a Quebec Zoological Garden publicity slogan, the catch phrase above expresses its "raison d'être" and declares its commitment to conservation. It is a statement of principle that must guide all our actions.

Following the example of several private companies, many zoological gardens have adopted an internal environmental policy in order to apply the principles of sustainable development. Thus, reduction of consumption, recycling, and reuse are now part of the objectives of the Metro Toronto Zoo. The environmental programme of that institution encourages each employee to do his or her share for the environment. The desire for efficiency on the environmental level explains why, for example, the Shangai Zoo makes it a point of honor to use the biogases produced by the organic wastes of its animals to heat some buildings. Zoos must commit themselves and take a stand as far as sustainable development is concerned. Maybe they could follow the example of the New Delhi National Museum of Natural History; its inauguration was held on Earth Day, 1978 (Nair, 1992). When will we dare to tackle the environmental balance sheet of our institutions?

SELF-MAINTENANCE OF COLLECTIONS

Commitment to the environmental debate must also rest on the self-maintenance of the living collections. As animal populations become scarce, our institutions must stop obtaining animals directly from the wild. We must give more space to species whose survival is closely tied to our breeding efforts and open our pens to the refugees from the wild, those wounded or abandoned animals that cannot be released back into their natural environments. We must not hesitate to get involved in programmes aimed at the survival and rehabilitation of rare species and to develop the necessary partnerships.

Too many zoological gardens still suffer from the menagerie syndrome. Believing that it is necessary to own an important collection, they acquire new animals without any clear planning. Animals are piled into confined spaces, and the common species become as important as the rare species, if not more. The congested pens soon deteriorate, and the food budgets take alarming proportions.

In an effort to rationalize the use of our installations at the Quebec Zoological Garden, we have reduced the number of bird species that we own; we now only own 125 species, down from the 300 species that we kept in the 1970s. Consequently, the number of hatchings has increased and the quality of our displays has improved a great deal.

Faced with closing, the London Zoo is doing away with its ancient menagerie image by focusing its collections toward the objective of species conservation. In 1991 alone, the bird collection was cut by 45%; the number of species thus dropped from 250 to 139 (Zoological Society of London, 1992). That kind of cut has the advantage of bringing about the specialization of collections and the development of more meaningful thematic displays on the educational level.

THINK GLOBALLY, ACT LOCALLY

René Dubos did not realize how right he was when he summarized the challenge that we must take up in our relationship with the global environment in the above statement. Our institutions must identify environmental issues at the local level and jump resolutely into the fire of the action. While getting ready for the Rio Summit, most of the participating countries published an environmental balance sheet describing the main national issues and proposing a national action plan. In the same way, albeit at the global level, Agenda 21 (adopted in Rio) and the recent version of the World Conservation Strategy entitled "Caring for the Earth" devote several pages to a global action plan (IUCN, UNEP, WWF, 1991). One can find a great number of ideas and projects to be undertaken in those publications.

For a few years, the Americana Zoological Park of Brazil has become involved in the struggle for the protection of the forests. Throughout the zoological park, one can find messages on the impacts of deforestation, which try to convince the visitor of the importance of reforestation. School programs, public lectures, hikes in the forest, and educational workshops support the same message by concrete actions at the local level.

At the Metro Toronto Zoo, the amphibian and reptile curator, in cooperation with the educational services, has launched a wide-ranging campaign for the protection of wet spaces by inviting each of the 5,000 Ontario schools to adopt, protect and enhance its own pond. At the zoo itself, students are shown how to set up an artificial pond and are made aware of the importance of wet spaces for the fauna. A similar program focused on the protection of bats has also proven very successful. When will we bother to make zoo visitors aware of hunting and fishing laws and regulations, the illegal trade of endangered species, the care of domesticated animals? When will we broach the delicate questions of overconsumerism, overpopulation, and the arms race?

Breeding programs must also take local issues into account. If we do not take care of our animal heritage, who will? Our institutions have the duty to contribute to the conservation of species endangered at the local level. The participation of The Chizé Zoological Park in the reintroduction of the lynx in France and that of the Calgary Zoo in the breeding and reintroduction of the swift fox in the Canadian prairies are examples that all zoological gardens should follow.

It is impossible to dissociate breeding programs from the efforts made to protect the natural habitats of animals. Thus, it was necessary for the zoological parks concerned to become involved when Przewalski's wild horses, born in captivity, were released in Mongolia; when the golden lion tamarin was reintroduced in the Brazilian rainforest along the Atlantic coast; and when the Arabian oryx was brought back to Arabia. It is not necessary to have the financial means of the New York Zoological Society, with offices in 41 countries, to do something in that field.

At the Quebec Zoological Garden, our commitment to the conservation of chimpanzees will soon enable us to undertake an assessment of the situation in Cameroon. In close cooperation with the Metro Toronto Zoo and the Cameroon government, we will try to identify the requirements for the protection of the apes in that African country and study the possibility of supporting the development of its zoological parks. Cooperating with animal management agencies and nature conservation groups working in the field will enable zoos to contribute in an original way to natural habitat conservation strategies (Prescott et Hutchins, 1991).

ANIMAL CONSERVATION EDUCATION: a priority for zoological gardens

Recently, the director of the Metro Washington Zoo appropriately mentioned that even if all the zoos of the world joined their efforts, they would find it difficult to support even 500 animal species (Sheng, 1989). On the other hand, zoos throughout the world are visited by more than 500 million persons every year. We must take advantage of this popularity to disseminate our conservation message.

First, we deliver that message through our animal displays. The physical arrangements for the animals, therefore, reflect our attitude toward the animal kingdom and affects the development of our visitors' attitudes.

From time immemorial, humankind's dominating attitude has been expressed in the digging of pits and the building of sterile cages with bars where the captive animal loses all hope of freedom. That type of display, unfortunately still popular today, conveys the concept of humans as superior beings, beings that naively believe themselves capable of controlling the forces of nature.

The development of the scientific fields of ecology and animal behaviour and the emergence of animal protection groups have fortunately led to the enlargement and naturalization of the cages and pens used in zoos. In the safari parks of the 1960s, visitors became voyeurs that invaded the habitat of wild animals while hiding in their cars, the barrier that still divides the human world from the animal world. In traditional zoos, the solid barriers are being replaced gradually by pits or more discreet fences. Arrangements then emerge that try to reproduce the species' natural habitat and encourage normal behaviour as much as possible.

The environmental movement in the 1980s and 90s drastically changed attitudes toward nature. Humans now consider themselves part of the biosphere and their survival closely linked to the future of other living species. And so recently we have seen the appearance in zoos of displays based on the immersion concept. The visitor literally enters the animal's natural habitat and discovers what is at stake in the protection of wilderness areas. These arrangements reflect the need to breed animals that are then displayed in natural social groups (Prescott, 1992).

We must display our animals in a setting that enhances them; that favors their well-being and their breeding; and that incites the respect, sympathy, and compassion of the public toward them. Without delay, we must transform the sterile cages of our zoos into naturalized habitats more consistent with our role in their conservation.

As far as information diffusion is concerned, zoos suffer great deficiencies. Numerous are the institutions that simply identify the species displayed. At best, they present disparate information on their natural history. Ecological concepts and environmental problems are rarely tackled.

Following the example of science museums, isn't it our utmost responsibility to explain to the public the problems that the environment faces? Shouldn't we make them aware that we must urgently find solutions to these problems, as mentioned at a congress of the International Council of Museums (ICOM) more than 20 years ago (Hudenbick, 1972)? Shouldn't zoos lead visitors to form an opinion in order that they, too, take a stand in the social debate (Davallon et al., 1992, p. 133)? Shouldn't they become a place for questioning and explaining (Davallon et al., 1992, p. 139), a place for meeting and debate, a catalyst for environmental action?

You probably think, and with good reason, that zoo visitors first seek an entertaining experience and that we must not bore them stiff with a political speech. I believe that is our greatest challenge.

As proposed by Emmanuel Coudel (in Davallon et al., 1992), we must establish a positive relationship with nature if we want people to take care of the environment. We must avoid complicating things needlessly, and we must avoid disarming visitors needlessly by confronting them too bluntly with environmental problems or by presenting those problems in too general a way. Our displays must stimulate the senses, explain the basic mechanisms of nature, and show how small concrete actions can make all the difference in the world.

Except for some institutions such as the Biochron of the Emmen Zoo in the Netherlands, the Living World Pavilion of the St.Louis Zoo, and the Discovery Pavilion of the Philadelphia Zoo, zoological gardens have made little progress in the field of museography. We must develop that field so that it will respond to our needs. By drawing on the experiments undertaken in nature interpretation centres and some science museums, places where those interactive approaches have been most applied, we can improve the intepretative techniques in zoological gardens.

By their nature, our institutions are in the centre of the environmental debate. The Biodiversity Convention adopted in Rio in June 1992 appropriately recognizes the contribution of zoological gardens to the conservation of species. It is our duty to be worthy of that recognition by committing ourselves resolutely to that endeavour. It is by carrying out concrete actions on the environmental stage that zoological gardens will secure their own future . . . **and the future of the biosphere.**

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Frontiers in solar boxes

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Two billion people in the world depend on wood for cooking and heating. Already 122 million people suffer from wood scarcity as forests shrink and human populations grow. Many women walk kilometres carrying loads of firewood.

INTRODUCTION

Can solar cooking be used to augment the traditional cooking facilities used by coastal fisher peoples and those trying to save forests and other ecosystems...even by the subscribers to GLOBAL BIODIVERSITY? Yes, indeed! There are a number of different designs of solar cookers. A basic, generic form is the solar box cooker (SBC). Among the possible choices, SBCs are the easiest for home construction and usually the most economical as regards material. They also cook small to moderately large quantities of food well. Since SBC's are usually flat on top, they stack well, and the large cavity can be used to store lightweight gear during the off season. They are useful in sunny locations at least as far as 50 degrees latitude although they work progressively faster as the equator is approached. Above 50 degrees latitude, it is better to have a somewhat slanted top, but the basic concept is the same.

Solar box cookers are light enough to carry, taken in Zimbabwe. (photo from Kevin Coyle, Resources Coordinator, Solar Box Cookers International)

▪ *For five months I have been using my cooker. When I started, I only used the cooker once a week to purify our family water. Now I use the cooker at least three times a week to cook food and every day to purify water. Our favorite foods that we have cooked are bananas and chicken in red sauce.*

Sofia del Cid
Trinidad, Honduras

HOW DO THEY WORK, EXACTLY?

When exposed to the sun, SBCs can reach temperatures ranging from 104° C (220° F) to 149° C (300° F). The mechanism is simple. Sunlight shines through glass or other glazing and falls on the black surfaces of a drip tray and dark pot with a dark lid. Tightly fitting pot lids prevent escape of steam and condensation on the glass. Usually there is a foiled box lid that serves as a reflector to add additional sunlight.Simply, this configuration traps solar energy in a well insulated space and converts it to a sufficient heat to cook food or pasteurize water.

One large SBC can cook food for eight to ten people at a time, requiring three to four hours of good sunlight for larger quantities of food or all day for the harder to cook foods like beans; easily cooked food in smaller quantities can be done in two to three hours or less. Up to 120 people have been served at one time from one location, using multiple SBCs.

ADVANTAGES OF SOLAR BOXES

One of our early favourites was solar baked fish. Placed on a dark tray with a dark lid to turn the sunlight to heat, it cooks gently and yet quickly enough that laboratory tests have indicated there is no problem with food bacteria. If there is enough sun to cook food, the temperature of the food quickly rises through incubation temperatures into the food safety zone. Out comes the food, delicious with extra full flavor. And there is no possibility of burning or charring! Meanwhile, the cook has been free to enjoy other activities since solar box cooking usually does not require tending. The use of home solar box cooking is an accepted luxury in an estimated 20,000 homes in the United States, But the impact of SBCs is potentially much greater.

▪ *I made my solar cooker with a lot of love. I am a widow and it helps me a lot.*

Concepcion P.
Suchitepequez, Guatemala

Solar box cooking is effective and can be hot - note use of oven mitts! Taken in Guatemala, Central America.

(photo from Resources Coordinator, Solar Box Cookers International)

SBCs provide multiple benefits to both cooks and the environment. We know that SBCs work well for women in many different countries, although their numbers are small. Grains, vegetables, meats, breads, cakes, and cookies can be prepared. A solar cooker uses a truly renewable resource, the sun; here comes the sun, here comes the fuel! How empowering to women to be freed from the labor-intensive task of fuel gathering. Here there is no gathering, no supply lines, no further cost, no smelly, inflammable, or explosive substance. The pots and food are hot, but there is no flaming or hot coals to burn the unwary. Also, not only are children and houses safe from flames, but the air is free of smoke as long as the sun does the cooking. The saving of fuelwood, or the expense of liquid fuels depends on the location. In some places, the estimated cost of cooking has been reduced as much as 50% by using SBCs on sunny days.

- *I'm getting too old and I can't do a lot of walking. The firewood is far away. Now, with the solar cooker, I don't have to go searching for wood.*

V.I.
Suchitepequez, Guatemala

Billions of people depend on wood fires to prepare edible food, but growing fuel shortages now threaten many with hunger and starvation. In another 10 to 20 years, 2.4 billion people reportedly will suffer from shortages of cooking fuels unless alternatives are in place. In developing countries, up to 80% of the felled trees are reported to be burned for fuel — mostly for cooking. Through the use of solar cookers, forests could have a better chance to regenerate.

- *The foods conserve their vitamins intact. I avoid damage from the smoke. I save money and fuel, and I have time to take care of other personal activities.*

Maria Isable N.
Nicaragua

NEW FRONTIERS FOR SOLAR BOXES

One frontier of solar cooking is the exploration of how the technology could be useful on shipboard. So far there is one report of a SBC being used with delight on the deck of a recreational sailboat. A SBC holds the potential to free up the person who has the responsibility for cooking on field expedition boats, some commercial fishing boats, or other vessels. In related context, we have been told that the administrator of a prekindergarten nursery school calculated the time savings by using SBCs for cooking the children's hot meal. Because the person who cooked was able to supervise the playground at the same time, the SBC provided the equivalent of another half-time staff person. The same dynamics would function on shipboard or for scientific field expeditions.

- *The most exciting thing about it is that you can just let it cook while your are minding your other things.*

Laura M.
Kenya

Another frontier is the issue of SBCs for food vendors. We know that SBCs have been used to prepare hot dogs and buns for sale on the Hopi Indian Reservation in Arizona. Pizza also has been cooked for sale in a specially designed 1.2 m (4 foot) and 1.6 m (5 foot) shallow SBC with a .63 cm (1/4 inch) metal absorber plate. Ginger cookies have been made for sale in Sierra Leone. It seems ideal for coastal and beach vendors as well as at fairs and rodeos. With a fleet of SBCs, loaded in rotation, a constant supply of food could be available. It could be cooked then and there in the sun, or some bulk foods such as chowders, bean pots, stews among others might be precooked. They could be

Note from the shadows that this cooker is aimed into the sunshine to maximize reception of sunshine in Djibouti, Africa.
(photo from Resources Coordinator, Solar Box Cookers International)

held hot and simmering in a SBC much easier than keeping such foods hot on a propane, kerosene or gasoline stove. And this is just the beginning! SBCs could be valuable assets in many fields.

▪ *This is cheaper. There is no pollution... In sunny weather, I set my food and leave it. You don't waste energy. You save wood. You can do other work while food cooks. Once I started, I never stopped.*
Sarah D.
Tsensete, Zimbabwe

MODELS AND SOURCES OF SOLAR BOXES

There are solar cookers for sale. So far the majority have been made of cardboard. Surprisingly durable, some SBCs have been used every summer for up to 12 seasons, perhaps refreshed with a coat of non-toxic house paint from time to time. Solar Box Cookers International (SBCI) has a foldable model that carries like a suitcase and can be opened in a few minutes to begin cooking. While SBCs are often made of cardboard, they have also been made of wood, metal, fibreglass, fluted polypropylene (flute board), bamboo, woven palm fronds, and wool fabric with loose bulk wool pads for insulation. We see no limit to the variety of material that can be used to enclose the cooking space depending on what is available, how weather resistant the SBC needs to be, and so forth. In general, natural materials are not destroyed by levels of heat SBCs reach. Size is also a matter of choice, but a minimum is 45 x 52.5 cm (18 x 20 inches), and they must be deep enough for the pots to be used. Sizes go up from here with the larger ones usually providing better cooking capacity.

▪ *The flavor is special. It's safer for the children. I don't damage my lungs. I use less energy. I'm preserving the flora and fauna of my country.*
Maria Elena C.
La Curva, Nicaragua

A serviceable, lightweight cardboard cooker can be made from the accompanying design on page 20. Plans with greater details, as well as the foldable cookers, are available from Solar Box Cookers International, 1724 Eleventh St., Sacramento, California 95814 U.S.A. *The expanding world of solar box cookers* provides great detail on each component of the generic solar box design. This textbook was written to guide those making individual models of SBCs and is available from B. Kerr, P.O. Box 576, Taylor, Arizona 85939, U.S.A. and costs $10, plus postage for locations outside the North American continent. Solar Box Cookers Northwest, 7036 18th Ave., NE, Seattle, Washington 98115, U.S.A. handles a variety of simple plans. Also, they publish *The Solar Box Journal*, which reports on activities in the field around the globe and also gives cooking tips and recipes. Kerr-Cole Solar Box Cookers, P.O. Box 27417, Tempe, Arizona 85285, U.S.A. sells plans for a large wooden model.

▪ *Solar box cookers are ready for use; are you ready for them? You'll love them!*

Increased use of Solar Box Cookers could give forests the much needed chance to regenerate.
(photo from Mali. Resources Coordinator, Solar Box Cookers International)

Simple Solar Box Oven

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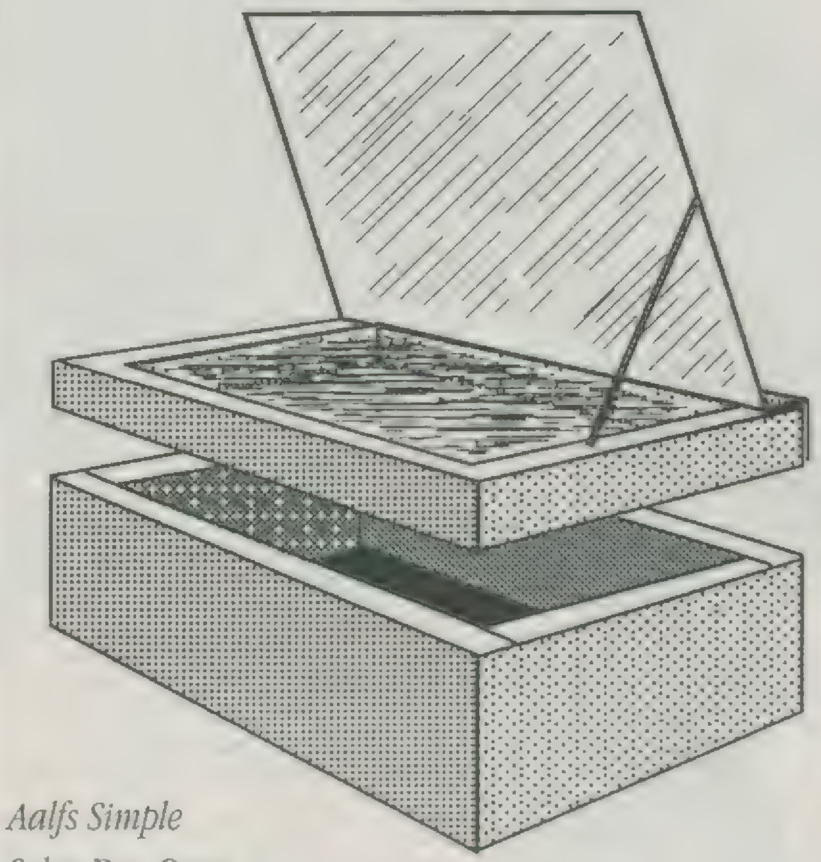


Aalfs Simple
Solar Box Oven

The Simple Solar Box Oven was designed to make available an effective solar oven that is easy to construct and makes use of cardboard in a readily available form—the cardboard box. The simplicity of design, the wide availability of cardboard boxes, the compactness when collapsed, and the portability should enable more people to enjoy the benefits of solar cooking.

Materials

The materials needed to make this solar oven are:

- one cardboard box with top and bottom flaps, figure 1
- flat cardboard for the top and reflector
- glass or high temperature plastic for the solar "window"
- aluminum foil, glue
- sheet metal for bottom absorber plate
- a wooden or wire prop stick
- durable tape (useful for either the foldable or permanent version of this solar box)

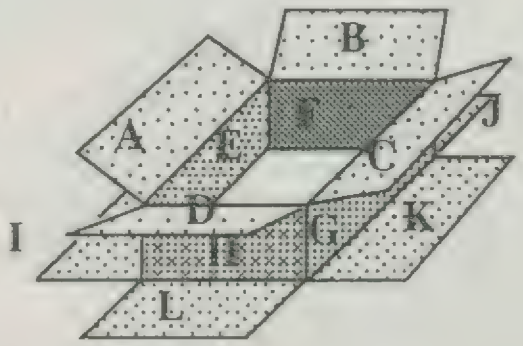


figure 1. Standard cardboard box.

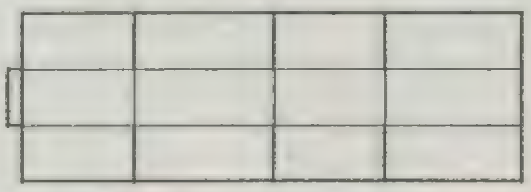


figure 2. Standard cardboard box laid out flat.

Construction Steps

1. Start with box with top and bottom flaps. figure 1. This solar box oven is made by simply folding in the top flaps of a standard cardboard box to form the inner box walls. The box dimensions should be from 7" to 10" (17-26 centimeters) deep and from 16" w x 20"l to 20"w x 30"l. The top flaps must be wide enough to provide enough depth for the inner box when folded in as in figure 3. If 8" flaps were folded in to make walls 1" thick, the box depth would be 6". This would likely be a minimum depth for most cooking needs.

2. Score the top flaps of the box.

Scoring and foiling the box is generally easier if the box is taken apart and laid flat as in figure 2. Score two lines on flap A as in figure 3. Score flap C the same as flap A. These folds will determine the thickness of the box walls. Wall thicknesses of .75" to 1.5" (2-4 centimeters) work well.

Score and cut flaps B and D as in figure 4a. It is important to do all scoring before the application of the foil. Once the foil is applied, scoring tends to rip the foil.

3. Glue foil to the box.

Glue aluminum foil to the inside surfaces of flaps A-D, sides E-H, and the bottom flaps, I-L. When finishing the box, if the bottom flaps are to glued shut, remove the foil where the glue is applied for better adhesion.

Glue foil to the outside surfaces to top flaps A-D. The surfaces that will become the top edges of the solar oven, as in figure 3, A1, should not be foiled.

Fold in flaps A and C. Fold flaps A and C into the box forming the inside wall as in figure 3.

4. Flaps B and D.

Flaps B and D have been cut, scored, and foiled in the previous steps.

Fold flap B into a "box" shape as in figures 4b and 4c. Fold flap B into the box to form the third side of the oven.

Repeat the above steps with flap D to form the fourth side of the solar oven.

5. Box bottom.

To complete the insulated bottom of the box, flip the box upside down as in figure 5a.

Make a box-shaped bottom piece, as in figure 5b. The bottom itself should be oiled on both surfaces, but the sides should not. This piece of cardboard, forming the bottom of the inner box, should rest on the flaps that have just been folded in—A, B, C, and D—to form the inner box walls.

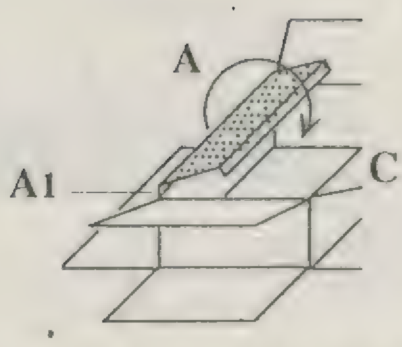


figure 3. Fold in the long flaps A and C.

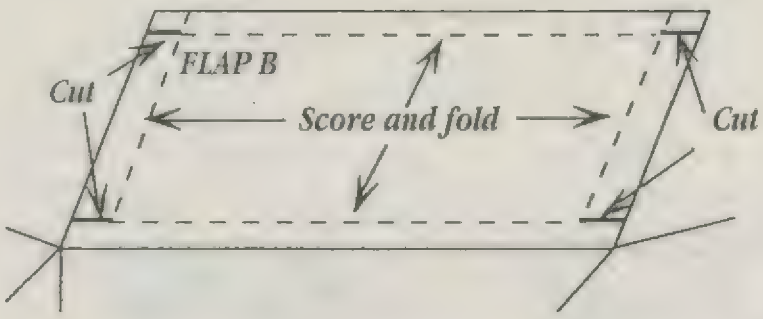


figure 4a.

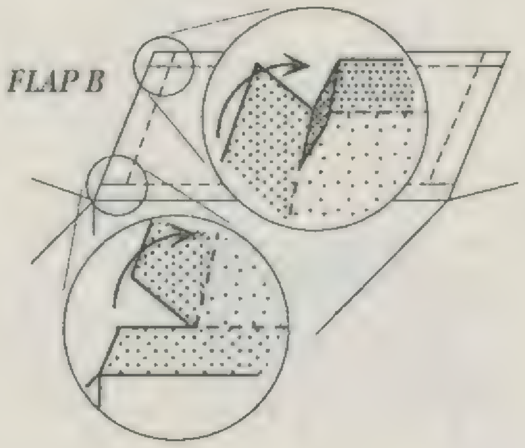


figure 4b.

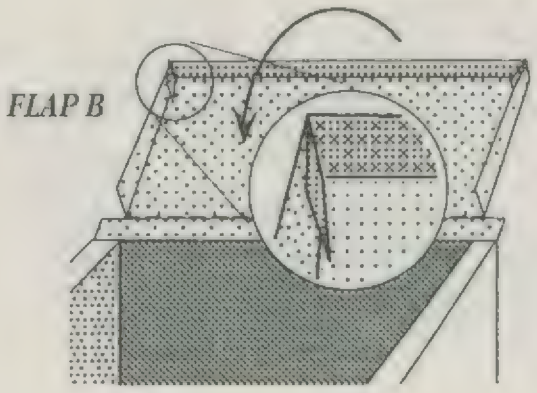


figure 4c.

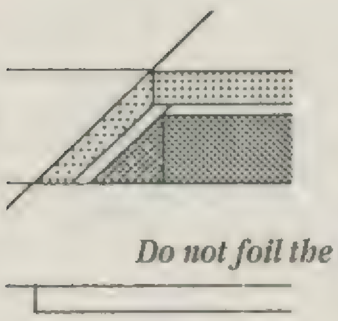


figure 5a.

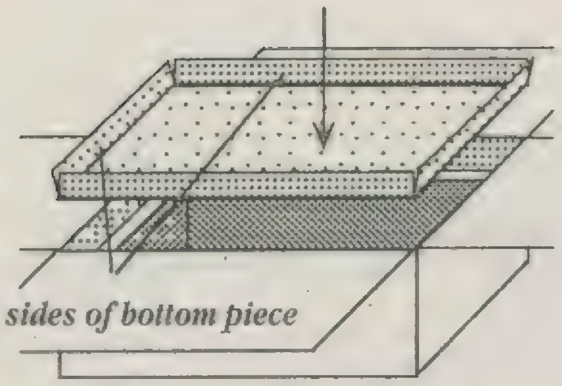


figure 5b.

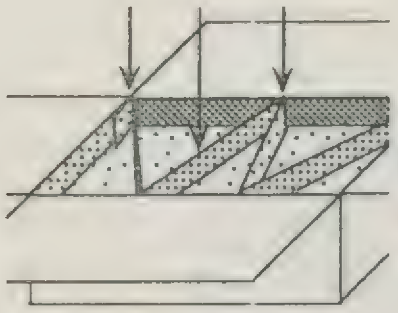


figure 6a.

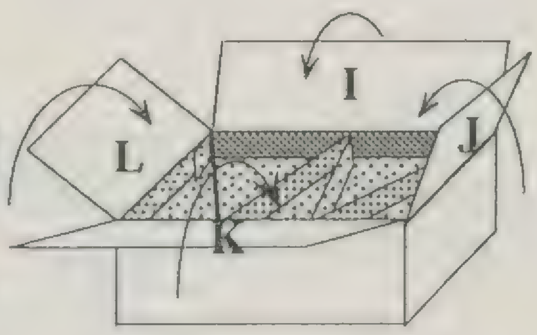
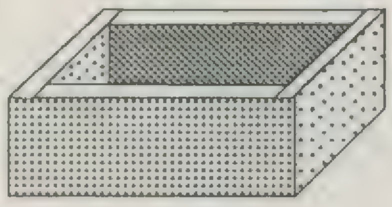


figure 6b.



Completed box.

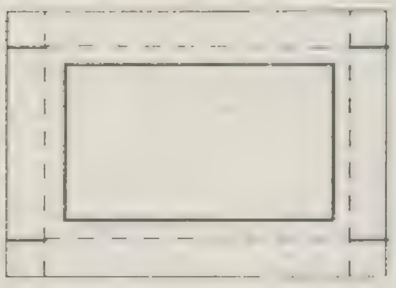


figure 7a.

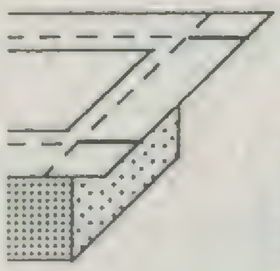


figure 7b.

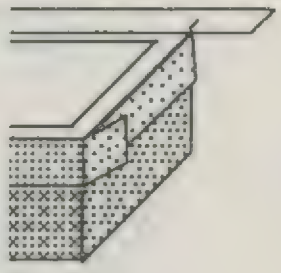


figure 7c.

6. Box bottom supports.
Insert structural supports into the bottom cavity as in figures 6a and 6b.

Cardboard pedestals or other supports will also work.

Close up the box bottom by folding in flaps J and L followed by the longer flaps I and K.

Collapsibility and portability.
For a box that does not need to be collapsible, the box flaps I and K may be glued in place as may the other parts of the box. For a collapsible and more portable box, the bottom flaps should be taped or secured temporarily by other means.

Completed box before the addition of the cover with glass or plastic solar window and a reflector.

7. Oven top with solar "window" and reflector.
The top and reflector of the solar box are made from one flat piece of cardboard, clear glass or plastic for the solar window, and foil for the reflector.

As indicated in figure 7a, cut the cardboard where the lines are solid. Score and fold on the dotted lines.

As shown in figures 7b-7d, fold the edge sections of the cardboard down around the top of the solar box. The tabs should be glued in place to form a snug-fitting top. If the top is too loose, warm air will leak out of the oven. If it is too tight it will be difficult to get on and off the oven.

For efficient, tight-fitting tops, the box can be rigged with handles made of tape or other materials to ease the removal of the oven top.

8. The reflector.
The reflector can be made by either of two methods. The simpler way is to form the reflector by carefully cutting the 3 sides of the reflector, sides 1, 2, and 3 as in figure 7d. Score side 4 and fold up the reflector. To maximize the amount of sunlight entering the solar box, take care to cut the hole for the reflector the same size as the opening on the top of the solar box.

The second method, although it requires somewhat more cardboard, is preferable because it results in a larger reflector and a bit more solar gain. As in figure 7d, cut the rectangular hole in the cover along sides 1-4. Again, these cuts should form a rectangle of the same dimensions as the interior of the solar cooker. The reflector should be the size of the size of the outside dimensions of the box with an additional 4-6" to glue the reflector to the cover as in figure 8b.

Glue aluminum foil to the reflector, taking care to keep the foil as smooth as possible to maximize the reflected sunlight.

With the top upside down, glue or tape plastic or glass into the oven window frame. Strips of cardboard around the edge may help to hold the glass or plastic in place.

Prop stick.
With the top upright, rig a method of keeping the reflector at the desired angle to reflect sunlight into the box. A sturdy stick or wire used with string or cord works well. To provide adjustability, a piece of wood or other material with holes for the stick can be mounted on the box cover as in figure 8a.

9. Bottom solar collector tray.
Cut a rectangular metal tray at least as thick as home flashing material (0.02" to 0.12" thickness recommended) to fit into the bottom of the box and paint the tray with barbeque black, or a non-toxic black or dark paint. This tray converts sunlight to heat and transfers the heat to the cooking containers. This tray is supported by insulating pedestals so that the metal tray is not in contact with the foiled bottom as in figure 8b. This separation results in greater efficiency by reducing conductive heat loss through the bottom of the solar oven.

Collapsibility and portability.
When portability is required, the Aalfs Simple Solar Oven can be collapsed to the original flat cardboard box configuration and even doubled over. The box, the additional bottom rectangle of cardboard and supports, the cardboard for the top and reflector, the plastic glazing material, and the solar absorber tray can all be packed together in a carrying box slightly larger than the length and width dimensions of the solar oven and only 4"-5" deep.

Reflector options.
Although solar box ovens generally work fine with just one reflector, other reflectors may be added to boost temperatures when cooking in less than ideal conditions.

The reflector may be articulated so that additional sunlight is reflected into the oven as in figure 9. When the sun is low in Seattle, this added energy input is very helpful.

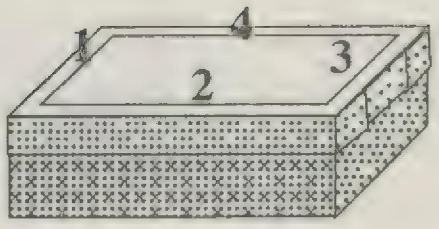


figure 7d.

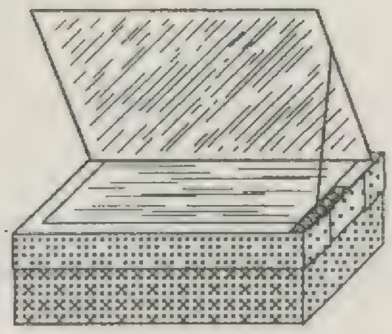


figure 8a.

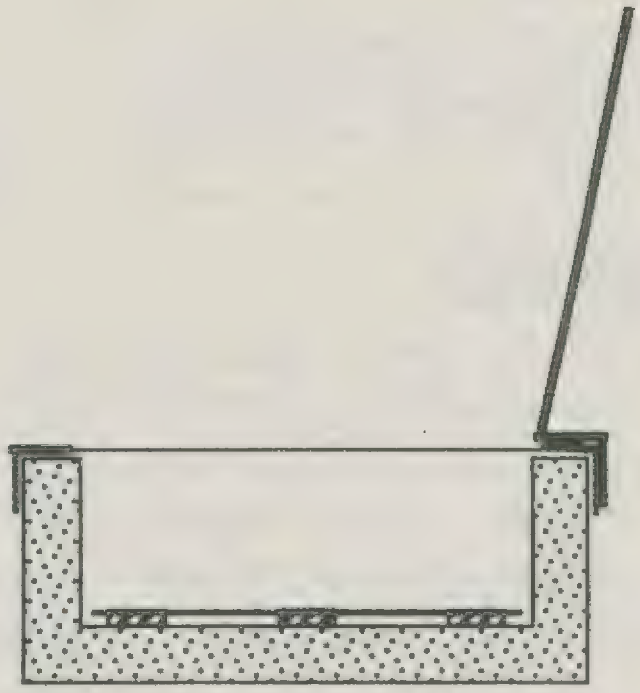


figure 8b.

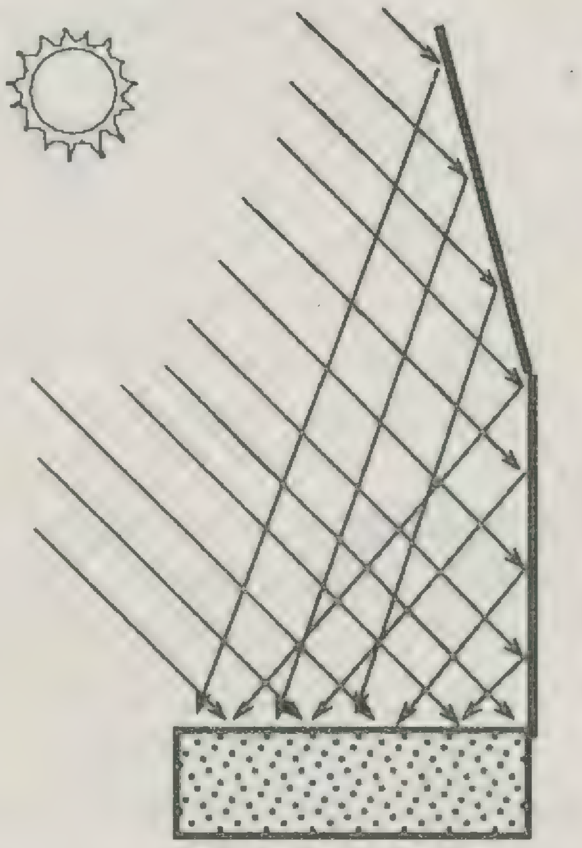
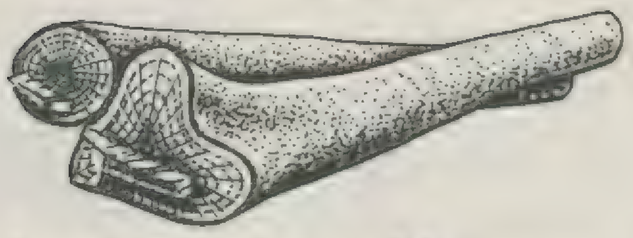


figure 9.



Tracking biodiversity for practical applications

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INTRODUCTION

Since 1986, The Smithsonian Institution/Man and the Biosphere (SI/MAB) program has been developing biodiversity monitoring projects in protected forested areas of several Latin American countries and the southeastern United States. The focus is on gathering information about tropical and temperate zone forest species and communities, and thus, gaining knowledge about changes in the ecosystems.

> ▪ *Once the natural patterns of species' change is documented, they become warning signs.*

Why monitor? Collecting baseline and repetitive data allows us to define the natural patterns of change in the composition and abundance of species in communities and ecosystems. Once these patterns are documented, they can become warning signs, which are useful in detecting further changes in biodiversity. We can then compare natural changes to human-induced ones and generate likely future scenarios based on our knowledge of the dynamics of species and communities (Dallmeier 1993, Davis 1989).

It is important to understand such changes. Evidence is rapidly growing to indicate that loss of forest biodiversity leads to the destruction of ecosystem equilibrium, and subsequently, to breakdowns in associated economic and social structures. If we isolate the causes of disruptions to ecosystems, we increase our opportunities to devise better techniques for maintaining ecosystem integrity, restoring degradated areas, and helping forest-dependent societies shape a more stable future for themselves.

SI/MAB's MONITORING PROGRAM

Despite our accumulated knowledge about species and ecosystems, we lack comprehensive programs for recording forest diversity over time and for predicting a forest's ecological patterns (Dallmeier and Devlin 1993). SI/MAB's biodiversity monitoring program is designed to fill these gaps. The broad goals are

- *to develop the guidelines for implementing biodiversity monitoring in a network of forested areas,*
- *to train in-country individuals in all aspects of monitoring, and*
- *to create a system that fosters the ready exchange of information*

(Dallmeier 1993, SI/MAB Biodiversity News 1991, 1992).

Figure 1 shows the steps in SI/MAB's program. The degree and precision of monitoring may vary from area to area, but the basic objectives remain the same. In particular, SI/MAB seeks to improve current scientific and research methodologies so that they center on the specifics of a site rather than on general descriptions. We are testing and refining our approach at our established permanent plots in Bolivia (Beni Biosphere Reserve), Puerto Rico (Luquillo Biosphere Reserve), Peru (Manu Biosphere Reserve),St. John (U.S. Virgin Island Biosphere Reserve), and Venezuela (Guatopo National Park). Additional work and a number of training courses are planned or are underway for Ecuador (Galapagos National Park), Guyana's tropical forest and in Front Royal, Virginia in the U.S.

THE THREE MONITORING LEVELS

Environmental conditions vary between and within the SI/MAB research sites. Therefore, sampling and monitoring methods must be validated to determine the most appropriate means of testing hypotheses about species interaction under current and likely future conditions. We strive to accomplish this through three levels of monitoring.

First, SI/MAB conducts periodic surveys and inventories of species abundance and distribution. This level includes collecting biological and environmental data to allow predictions of future changes. At Luquillo Reserve in Puerto Rico, for example, we were fortunate to establish our research monitoring plots and complete our initial survey before the advent of Hurricane Hugo. Subsequent inventories are providing a great deal of insight into natural regeneration following such a cataclysmic event. Sometimes, site-specific surveys and inventories prove to be the only way to gather data. This was the case at Beni Biosphere Reserve in Bolivia and Manu Biosphere Reserve in Peru, where other records for portions of these areas did not exist.

The second level of monitoring entails the interpretation of forest dynamics with regard to indicator species and selected vertebrate species. Such data provide a reference for studying the health of populations in relation to environmental factors. Some of the parameters measured are growth, mortality, and

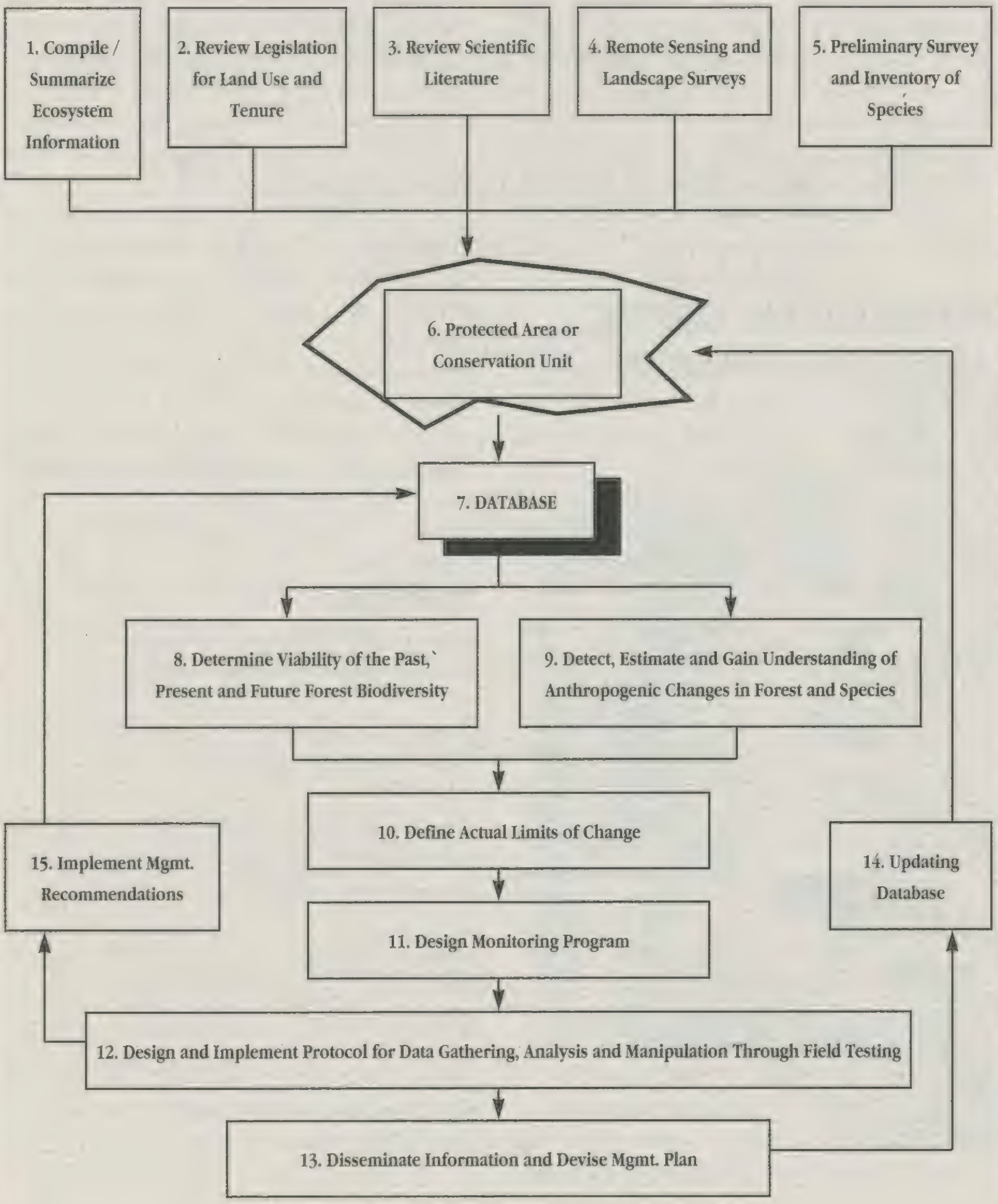
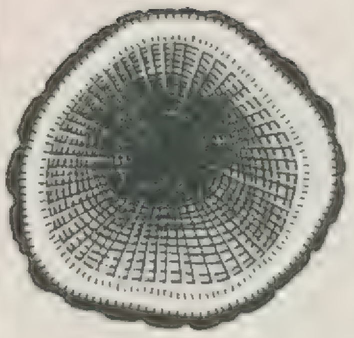

1. Compile / Summarize Ecosystem Information
2. Review Legislation for Land Use and Tenure
3. Review Scientific Literature
4. Remote Sensing and Landscape Surveys
5. Preliminary Survey and Inventory of Species
6. Protected Area or Conservation Unit
7. DATABASE
8. Determine Viability of the Past, Present and Future Forest Biodiversity
9. Detect, Estimate and Gain Understanding of Anthropogenic Changes in Forest and Species
10. Define Actual Limits of Change
11. Design Monitoring Program
12. Design and Implement Protocol for Data Gathering, Analysis and Manipulation Through Field Testing
13. Disseminate Information and Devise Mgmt. Plan
14. Updating Database
15. Implement Mgmt. Recommendations

Figure 1.
The steps and objectives in SI/MAB's monitoring program stay the same from place to place, but the degree and precision of monitoring can vary.



reproduction rates as well as age structure and phenology. Changes in populations of indicator species are particularly helpful in ascertaining ecological health since these species are important components of the forest community as a whole. Their presence gives you a quick snapshot of the whole biological situation. For instance, if there are trout in a stream, one can safely assume the water is clean, the temperature cool, and oxygen levels high.

At the third level of monitoring, researchers describe ecosystem diversity through ecological assessment methods. The methods incorporate technologies such as geographic information systems, satellite images, color and infrared aerial photographs, and on-the-ground verifications. This overlay of information provides details of ecosystem diversity in specific areas. It is very useful in selecting sites for long-term monitoring or that require special management because of the damage revealed by the technologies used.

PROTOCOLS FOR DATA GATHERING, ANALYSIS, AND MANIPULATION

Efficient data management systems are key to a successful, long-term monitoring program. SI/MAB develops protocol for data gathering, entry, analysis, interpretation, and storage at each research site, covering most of the components that are monitored. The objective is to assure consistent data collection and management.

Under the protocols, results and recommendations from the monitoring programs are compiled and made available in periodical reports. The protocols address methods and timing for publication and dissemination of material, the proper format for publication, and the appropriate standards for review. SI/MAB's user and field guides (Dallmeier 1992, Dallmeier et al. 1993a,b., Dallmeier et al. 1991a,b.), are helpful tools in evaluating and improving the procedures and techniques formulated in the protocols.

TRAINING

As noted, monitoring forest diversity entails a number of repeated surveys and inventories over time. SI/MAB has found that such work can be costly and difficult to conduct. In addition, many developing countries lack the highly skilled personnel needed to identify precisely the elements of forest diversity. Even in developed nations, adequate human and financial resources may not always be committed to appropriate monitoring. Given these factors, researchers must agree on the location, forest community, and methods required to measure the health of forest ecosystems. Then they must establish consistent sampling protocols (described above) for long-term data gathering, analysis, and reporting.

SI/MAB emphasizes these aspects of monitoring in its intensive training courses of four to six weeks duration.We share the knowledge of what we have found works at our several research sites with a wider audience. The courses, combining classroom and field work, bring together a multidisciplinary team of qualified instructors and a variety of participants that include local people. At the end of each course, participants complete a basic monitoring program for the particular site, and local agencies are encouraged to take responsibility for carrying out the plan.

On a final note, successful implementation of the monitoring programs requires adequate human resources and facilities, the careful management of information, and a strong governmental and institutional commitment. A critical mass of researchers and program managers trained in biodiversity monitoring and data analysis should be joined by social researchers, land managers, and trainees. In the meantime, SI/MAB continues its efforts to create such teams and ensure the commitment of appropriate resources so that the task of long-term biodiversity monitoring can proceed.

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Within a thin film of life on the surface of a spinning planet

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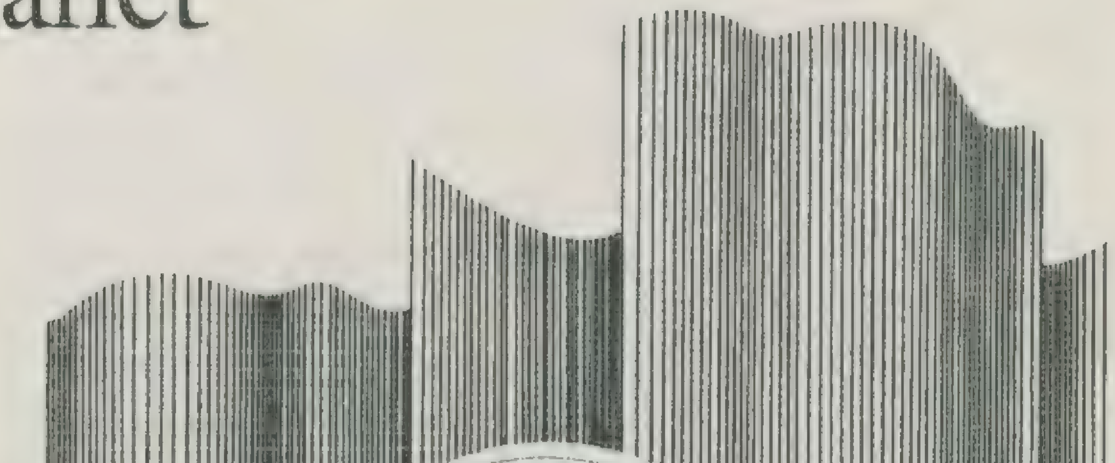
We are discovering facts about the way the world works that throw fresh light and emphasis on what and who and where we are. We are now coming to see ourselves as members of a species, shaped by diverse cultures and experiences, situated within a thin film of life on the surface of a spinning planet.

Suppose that this new appreciation reveals the opportunity for humanity, acting intelligently on the basis of this emerging picture of itself, to live in peace and prosperity and with justice among its members. Suppose, also, that the people of Canada, through example and suasion, could play a crucial role in facilitating the emergence of such an intelligent response among humankind generally. Suppose, too, that it were greatly to Canada's advantage to play this role, openly and vigorously. Would Canadians choose to do so? If not, why not? If so, how might we mobilize our energies to pursue such an accomplishment?



After Rio:

Why is Canada burning its institutions for research and training in biosystematics?

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It's not just the rain forests that are going up in smoke. Canadian research and training in biosystematics are starting to flame, too. Cutbacks to systematic entomology programs across Canada, in which detailed research on the classification, evolution, and ecological relationships of insects is carried out, is the leading indicator of a general decline in biological research and training. It is ironic that this disturbing trend should be felt most strongly right after the Rio Earth Summit - right after our government signed the Convention on Biodiversity.

To help the lay person understand the significance of losing these programs in systematics research and training, I shall briefly define "biodiversity" and "systematics":

Biodiversity is the diversity of life - its species and their populations, its genes and the life forms of individuals, the habitats and communities into which they organize themselves, and all the different combinations in which they occur. Biodiversity of both the wild and agricultural world provides us with living products: foods like vegetables, fruits, and meats; industrial products like starch, alcohol, and carbon; fibers for clothing; building materials for houses; and for millenia, medicines. Combined into ecosystems, the world's diverse species also provide a multitude of services, from purifying our water to replenishing the oxygen we breathe.

Systematics is the study of the evolution and classification of living organisms, including microorganisms as well as the flora and fauna that make up the diversity of life. The science of biosystematics or systematics provides the basic step of determining, describing, naming, and identifying what diverse species exist, where they exist, and how they fit into the evolutionary plan of life on this planet. Secondly, systematics provides the scientific names and evolutionary relationships so those in other areas such as ecology, genetics, biogeography, conservation, resource management, health sciences and biotechnology can share knowledge. Thus science, technology, and the bio-industries all depend on fundamental knowledge provided by systematics.

▪ *Biodiversity is the unopened book; systematics opens the book and provides the language for learning.*

Despite the demonstrated need for systematics, financial support for systematics research has declined markedly during the past decade. Over the last 20 years the number of professionals employed in Canada by the federal government to identify and name insects and mites dropped by almost 50% to only 21 individuals, and for nematodes (roundworms) from 6 to 1 specialist. Universities are not faring any better. At current attrition levels, in two years there will be only seven faculty positions for insect systematics across Canada. (Heraty, Ent. Soc. Can., 24:103, 1992).

So many different universities and museums are facing cutbacks that it is impossible to discuss each and every situation in this article. I will focus, therefore, only on the programs in three universities. These particular institutions are renowned for systematics training of entomologists in North America.The Systematic Entomology Program at the Department of Entomology, University of Alberta has an international reputation for excellence. The Department has supplied by far the largest number of systematic entomologists to academic and research institutions in Canada, and many are employed at top research institutions around the world. In 1992 the retirement of Dr. George Ball placed the training program in jeopardy, as the university administration has chosen not to re-fill the position with a systematist. The replacement program will focus on molecular biology instead of focusing on the biodiversity-oriented whole organism, which uses molecular biology as a supporting tool. The University of Alberta, in effect, "has closed its program." (Kingsmill, Nature Canada, Spring 1993, Pollinators in Peril).

Two other leading systematic entomology programs in universities are in similar jeopardy. Carleton University in Ottawa, Ontario is facing the pending retirement of its systematist with no confirmed plans to fill this position with a person of similar training. McGill University in Montreal, Québec currently has no systematist on staff, and although I understand McGill is considering filling the vacant systematist position, "lack of funding," the classic dead-stop to biodiversity research, is the problem.

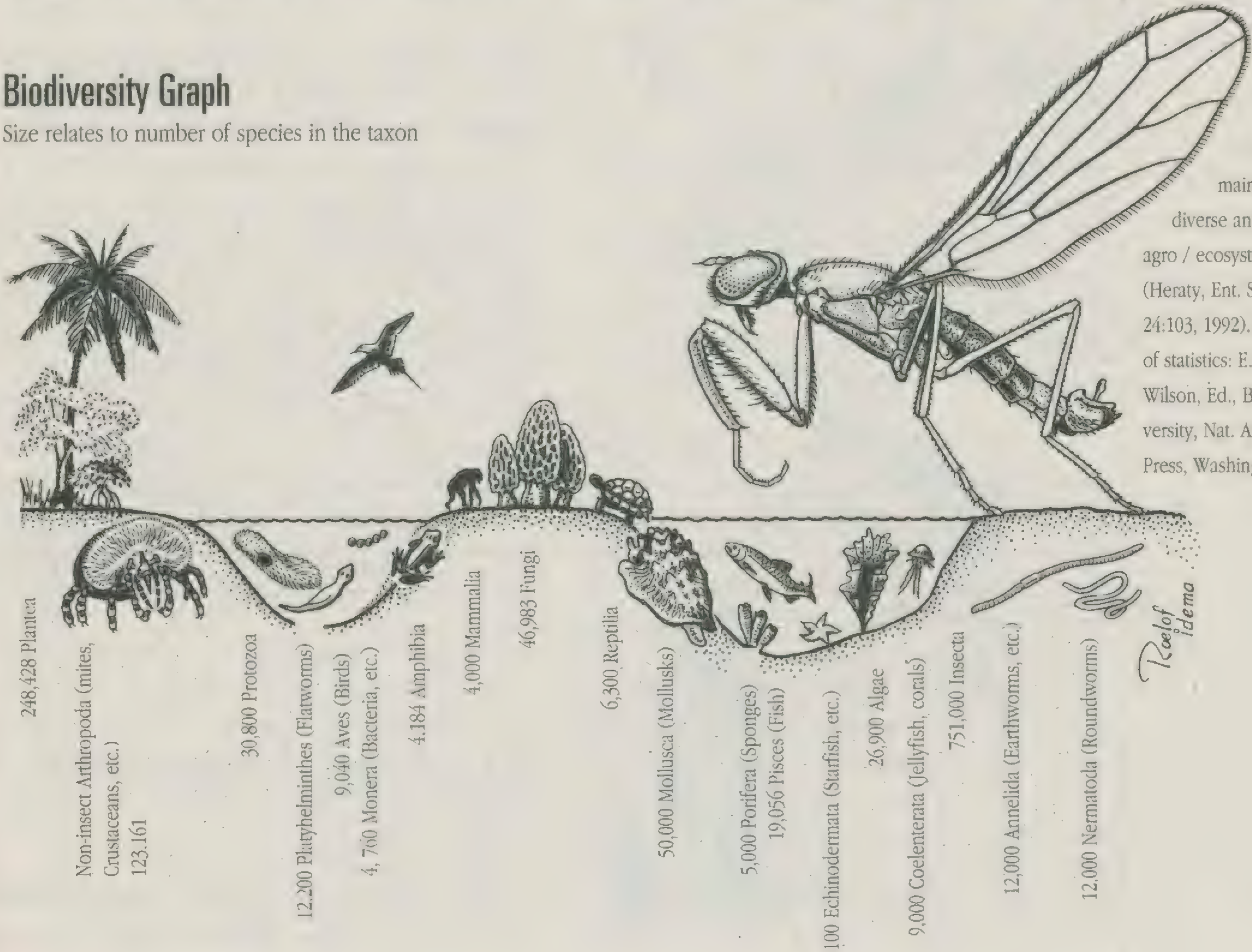
Just as we are losing taxonomists to attrition, we are losing species to deforestation and environmental change at a projected loss of 25% over the next 20 years. How are so few biologists going to collect and classify so many species for Canada's "National Inventory of Biodiversity"? How will they answer questions of declining biodiversity and ecosystem alteration? How will they deal with exotic introductions of pests, identify biological control agents, provide support for the new biotechnology industry, or track the movement of species during environmental changes?

Ironically, this decline of university systematics training corresponds with a period of increased public awareness about the biodiversity crisis. Canada was a key player and signatory of the Convention on Biological Diversity, and the federal government scored fantastic

The biodiversity graph gives an indication of the number of described species in each of the major taxa, totalling nearly 1.4 million. Conservative estimates for undescribed species run between 5 and 30 million. Thus at best, we can identify and name only about 8% of all insect species. Of the known species, little has been learned of their biology or the importance of their interactions in the environment. We can make few predictions as to which species are crucial in maintaining diverse and healthy agro / ecosystems. (Heraty, Ent. Soc. Can., 24:103, 1992). Source of statistics: E.O. Wilson, Ed., Biodiversity, Nat. Acad. Sci. Press, Washington.

Biodiversity Graph

Size relates to number of species in the taxon



political kudos for saving the Earth Summit despite the attempts of other nations to sabotage it. Canada signed and ratified the Convention. But away from the spotlight, it quietly turns around, and perversely, slowly, burns down our internationally recognized systematic teaching faculties.

The universities in Alberta, Québec, and Ontario are, of course, not federal institutions, though their research is supported in part by the Natural Science and Engineering Research Council grants. We can only hope that provincial jurisdictions will recognize the aims and principles of the Convention on Biological Diversity, as has the federal government.

Maurice Strong, Secretary-General of the United Nations Conference on Environment and Development, proudly reports the Canadian signing of the Convention and lists 13 sections of its "Agenda 21" in his "After Rio Editorial" (Canadian Biodiversity 2(3): 2-4). Five sections are particularly applicable, calling upon governments to implement the following clauses:

Convention on Biological Diversity

(ii) develop national biodiversity strategies and integrate them into national development strategies and plans;
(iii) implement measures for the fair and equitable sharing of benefits derived from research and development and use of biological and genetic resources;
(iv) carry out country studies;
(vii) implement mechanisms for the improvement, generation, development and sustainable use of biotechnology and its transfer;
(xi) develop methodologies for the systematic sampling and evaluation of the components of biodiversity.

Mr. Strong writes about the comprehensive nature of the consensus and considers it a "major breakthrough, not least in terms of a political recognition that the sustainable use of biological resources would be a vital key to human development in the future." He goes on to state, "It is more urgent than ever for the international community to follow through and to build upon what was agreed at the Earth Summit...History will base its judgement ...on what will be done in the years ahead to implement programmes in Agenda 21."

How can we achieve the Convention's objectives if we do not even train systematists to carry out the basic research of a country study, to interpret the results, and to tell us what our resources are?

I propose six positive steps to assure that Canada develops a generation of well-grounded systematists to carry out the work to which our leaders committed our country with their signature of the Convention on Biological Diversity:

Six Positive Steps

(i) that the Federal Government recognize that the real foundation of its commitment to the Convention is education at the university level and recognize that the universities and provinces alone do not have the financial resources to carry out the job of training scientists; that the Federal Government share the responsibility it has signed for by putting its Green Fund money into such established faculties as the Systematic Entomology Programs at the University of Alberta, McGill University, and Carleton University to at least maintain the status quo and that it concern itself with "PR" spending later, if at all;

(ii) that an Endowment Fund in aid of the Systematic Entomology Programs be set up to accept tax-deductible donations from the private sector, possibly through a non-profit NGO such as the CanaColl Foundation;

(iii) that the signing of the Convention on Biodiversity be followed up by creation of the new professional positions in systematics, behaviour and ecology required to carry out the massive programs envisioned by Maurice Strong; this would reverse the trend of students being turned off biology due to lack of recognition and lack of job prospects;

(iv) that a "Work Plan" indeed be set up by Environment Canada, specifically for the teaching of biosystematics, as the Hon. Jean Charest, Minister for the Environment, suggested when he said the department is establishing a "multi-stakeholder" group to "set up work plans for each Earth Summit issue that demands one, and set up a system to keep track of them." (Southam News, 29 November 1992);

(v) that Canada implement the 23 recommendations as stated in the Report of the Standing Committee on Environment, House of Commons Issue No. 62, 22 April 1993. This committee was responsible for Canada's ratification of the Convention of Biological Diversity, also published in Issue No. 62.;

(vi) that concerned parties personally communicate with the respective universities, provincial governments, and the federal government to press their points of view. One grass roots petition is already circulating.

Let's put the fire out now...before it is too late.
I encourage you to express your point of view to these university departments:

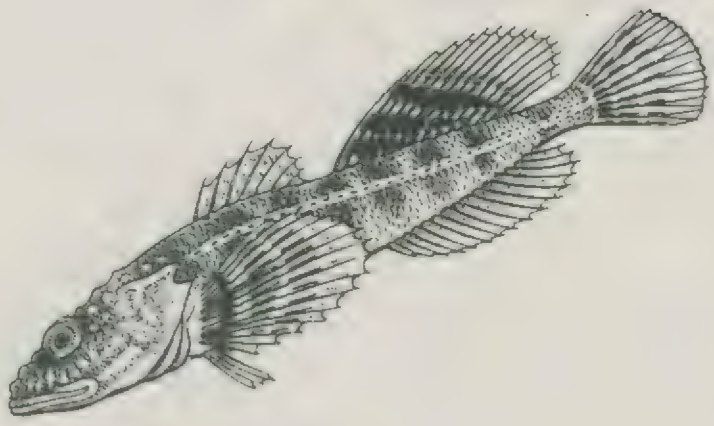
Dr. E. Tyrchniewicz, Dean,
Faculty of Agriculture and Forestry,
214 Agriculture and Forestry Centre,
University of Alberta,
Edmonton, Alberta, T6G 2P3, Canada

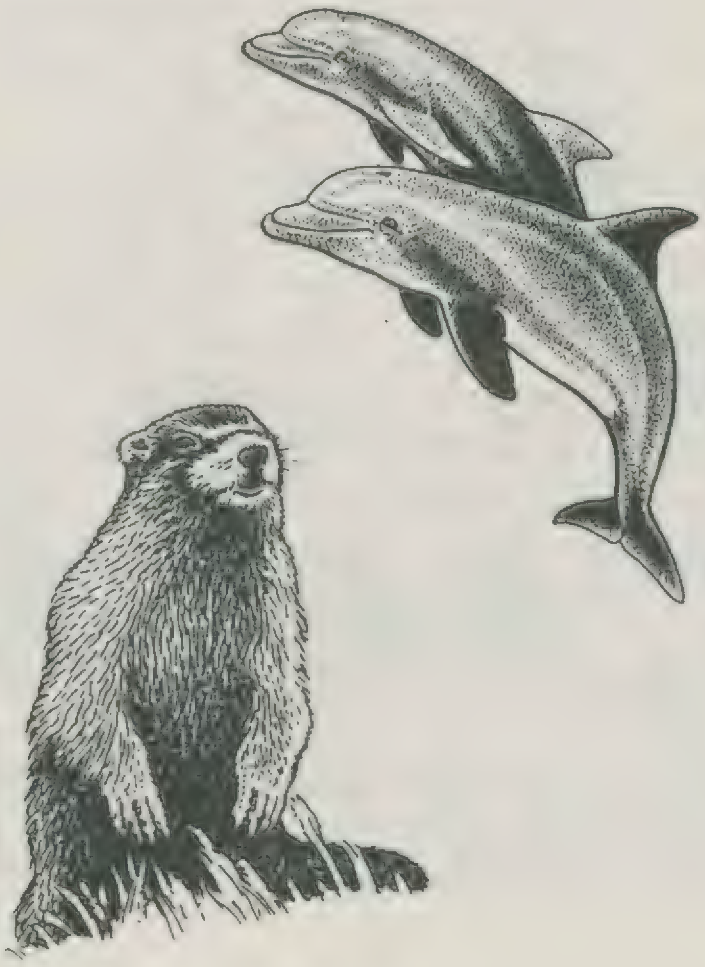
Dr. D.R. Gardner, Dean
Faculty of Agricultural and
Environmental Sciences,
Carleton University,
Colonel By Drive,
Ottawa, Ontario, K1S 5B6, Canada

Dr. Roger Buckland, Dean,
Faculty of Agriculture,
MacDonald College Campus,
McGill University,
21111 Lakeshore Road,
Ste-Anne-de-Bellevue,
Québec, H9X 1C0, Canada

Canada's research strength in biology is internationally recognized above all other sciences, despite minimal funding. Further cuts will be most felt at the level of training young scientists. It is important to co-ordinate efforts to secure funding in support of biosystematics training, and therefore, readers are urged to copy any correspondence to:

Dr. Clement Gauthier,
Science Policy Officer,
Canadian Federation of Biological Societies,
360 Booth St., Ottawa, Ontario, K1R 7K4, Canada





■ ■ ■

Diverse Quotes

■ *Complex beyond understanding and valuable beyond measure, biodiversity is the total variety of life on Earth.*
John Ryen (1992)

Vast soil fungal networks sustain forests.

Is the hidden tree-fungus partnership in crisis?

Don E. McAllister
Canadian Centre for Biodiversity
Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, Ontario K1P 6P4, Canada

Do you know that each time you walk in a forest, there is a vast sophisticated network of fungal hyphae under your feet? These hyphae, or thread-like tubes, are part of a mycorrhizal (pronounced mike-o-rizal) relationship between trees and fungi. The fungi consist of a mantle covering the root tips of trees and very slender hyphal threads penetrating the soil. The root-fungus association structure is called a mycorrhiza; I call mycorrhizas *mycos* for short. In Canada's forests, the predominant mycos are ectomycorrhizae, or literally, outer mycos.

The mycos gather and transmit nutrients (from both the water films and particles of organic matter) and moisture (from the water films surrounding the soil particles) to the rootlets of the tree. The tree, in turn, passes back carbon fixed by the sunlit tree leaves in the form of a sugar. This vital partnership enhances tree growth and may protect the roots from harmful species of fungus, and in turn, sustains the tiny fungi. Some of the fungi only become visible to the naked eye when they push up through the surface of the soil as mushrooms. While you may have seen the whitish mycorrhizal network on tree roots when digging up a tree, other mycos are brown, black, yellow, and orange. The above-ground mushrooms release tiny spores to be borne by winds and animals to seed new sites. Other species such as truffles bear their spores underground. Then they are dug up, eaten, and dispersed by mammals, such as flying squirrels, in their droppings.

▪ *Under a single healthy tree there are enough fungal filaments to stretch around the equator 5 times.*

Studies show that healthy forest soils have several kilometers of hyphae in a gram of soil (Amaranthus, M.P., Trappe, J.M. and Molina, R.J. 1990. Long-term forest productivity and the living soil. In: D.A. Perry, et al, eds. Maintaining the long-term productivity of Pacific Northwest forest ecosystems. Timber Press, Oregon, pp. 36-52). That remarkable figure gives the first indication of the importance of the tree-fungus partnership. A fuller picture is obtained when we calculate the length of the fungal network under a single tree. For ease of calculation we will assume that

1) the roots of a particular tree occur within an area 5 m by 5 m square,
2) each gram of soil occupies a volume of 5 cm^3, that, conservatively, contains a single (not several) kilometer of hyphae, and
3) 5 cm^3 of hyphae-bearing soil lies under each cm^2 of soil surface. This means that under a single tree there is 250,000 km of fungal hyphae (500 cm x 500 cm x 5 x 0.2 x 1)! The circumference of the globe at the equator is about 40,000 km. Unravelled, the hyphae from under one such a tree would stretch around the equator more than five times!

Now imagine unravelling the network of fungal hyphae from under the 4.5 million km^2 of Canada's forests. They would reach a length of 6 x 10^{15} km. This is a figure hard to grasp without reference to astronomical examples. The distance from Earth to the nearest star, Alpha Centauri is 95 million million km, or 9.5 x 10^{13} km, and that is still too short! Quite a network!

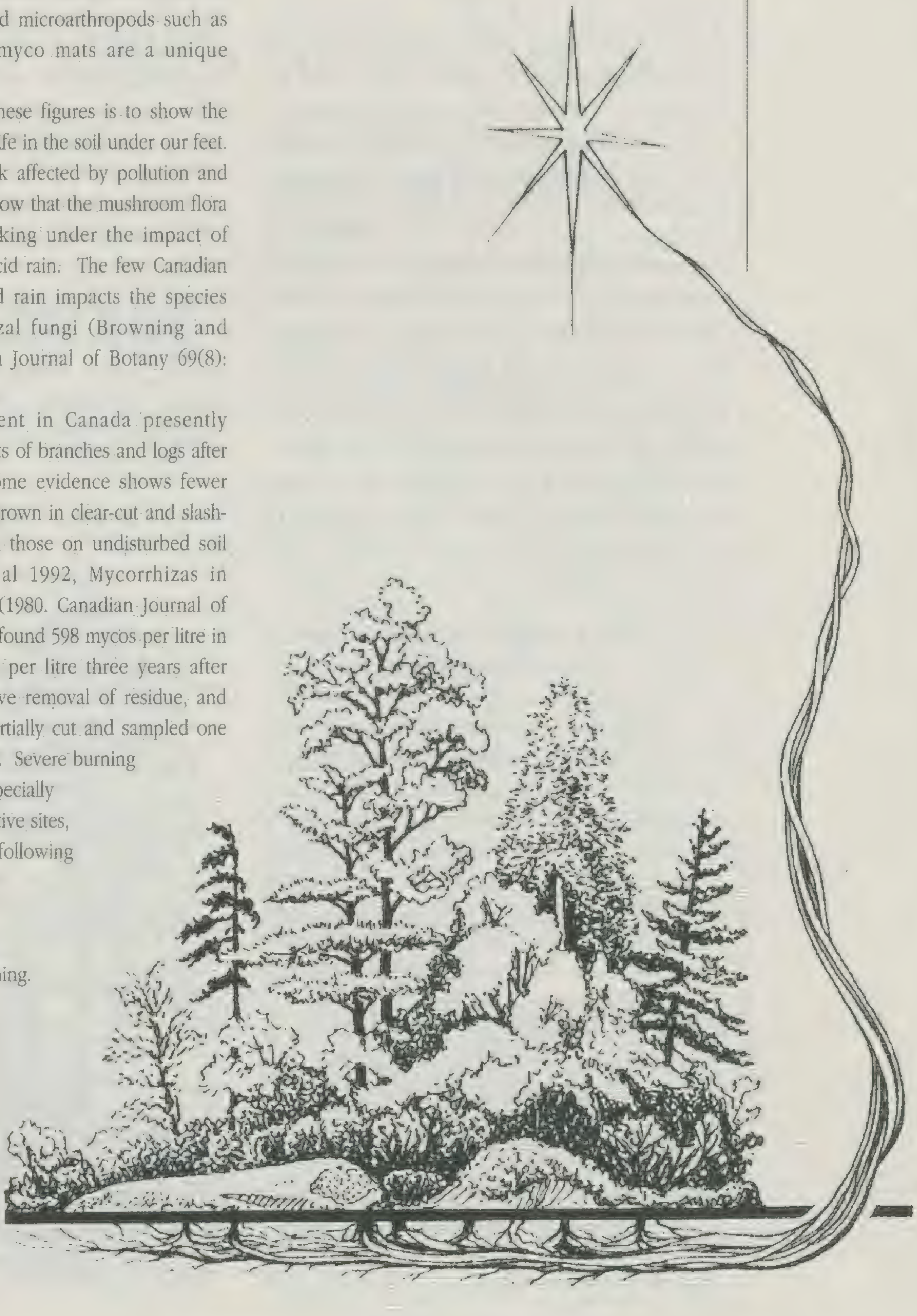
▪ *If linked end-to-end, the forest mycos of Canada would reach past the nearest star.*

In some forest soils, there is a rich diversity of mycorrhizal species. And one tree species alone can forge links with up to 100 different fungi (Hawksworth 1991, Canadian Biodiversity 1(4): 4-10). In other cases, thick mats of hyphae are dominated by a single species. Mats may have a biomass equivalent of up to half the mass of the soil in which they occur (Friffiths and Calwell in Read et al 1992, Mycorrhizas in ecosystems). These myco mats accelerate mineral soil weathering, provide access to nitrogen and phosphorus nutrients for tree roots, and could increase overall forest biodiversity of protozoa, round worms, and microarthropods such as mites and insects. The myco mats are a unique ecosystem.

The intent of all these figures is to show the intricacy and significance of life in the soil under our feet. How is that intricate network affected by pollution and forestry practices? Studies show that the mushroom flora of Europe is rapidly shrinking under the impact of atmospheric pollution and acid rain. The few Canadian studies also show that acid rain impacts the species composition of mycorrhizal fungi (Browning and Hutchinson 1991, Canadian Journal of Botany 69(8): 1691-1699).

Forest management in Canada presently involves burning the remnants of branches and logs after clear-cutting the trees. Some evidence shows fewer mycos on conifer seedlings grown in clear-cut and slash-burned soils compared with those on undisturbed soil (Amaranthus in Read et al 1992, Mycorrhizas in ecosystems). Harvey et al (1980. Canadian Journal of Forest Research 10: 436-440) found 598 mycos per litre in undisturbed forest soil, 164 per litre three years after partially logging and intensive removal of residue, and only 32 per litre in a site partially cut and sampled one year after it was slash-burned. Severe burning and loss of organic matter especially reduce mycos. Some productive sites, however, show no reduction following clear-cutting and burning. Presumably sites with deep rich soils can, at least initially, withstand the impacts of burning.

After replanting or natural regeneration in the clear-cut areas, herbicides are sometimes applied to control unwanted trees, shrubs, and weeds. What does that do to mycorrhizal fungi? No one knows. Answers are needed.



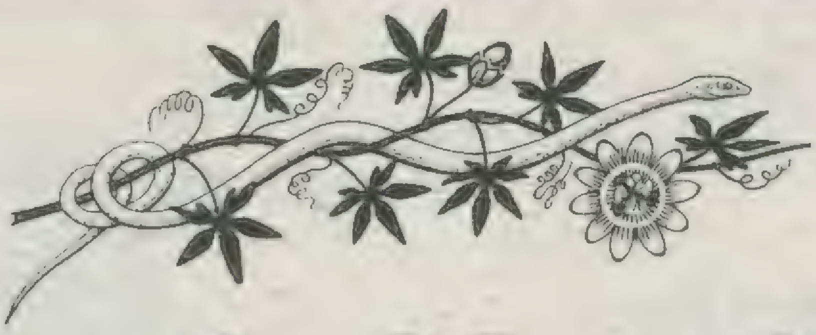
Environmental organizations and governments alike have concentrated their concern on the conservation of the higher vertebrates — birds and mammals, larger showier plants, forests and flowers — and given little priority, if any, to microorganisms. Yet. as we have seen with mycos, microorganisms sustain the pyramid of life. The International Union of Biological Sciences and the International Union of Microbiological Societies have declared an International Decade of Microbiological Diversity, Microbial Diversity 21 (for the 21st century). They announce that microorganisms (i.e. algae, bacteria, fungi, protozoa, viroids, and viruses) are vital to the function and maintenance of the Earth's ecosystems and biosphere. As major contributors in biogeochemical cycles, they perform unique and indispensable activities in the circulation of nutrients and organic compounds, on which all larger organisms depend, including us! Microorganisms constitute a genetic resource with great potential for contributing to the sustainable development of the planet as well as human, animal, and plant health. Urgent attention to redress our ignorance on many key aspects of their taxonomy, their geographic distribution and ecological functions is required. For further information contact: Dr. D.L. Hawksworth, International Mycological Institute, Kew, Surrey, TW9 3AF, U.K.

- *We do not fully understand what effect various forest practices have on soil fungi.*

The point is we do not fully understand what effect various forest practices have on soil fungi. A forester told me that there is no evidence for decline of forest fungi in Canada. In fact, there doesn't seem to be any published, base-line Canadian data from which decline or health of soil fungi can be evaluated. One could surmise that small-scale deforestation and selective logging probably permit fungal spores to repopulate harvested areas and recover, while large-scale clearcutting and burning retards this process. The clearcutting itself probably dries out the soil in summer and encourages erosion, and it seem likely that slash burning also dries out the soil moisture or creates lethal soil temperatures. To what degree will forests and their mycorrhizal partners be affected several tree harvests down the road under present management practices? Is the growth of trees being retarded and the diversity of forest species in forests being reduced by changes in soil fungi? We do not know, it seems. Isn't it time we found out for other soil organisms as well as for mycos? That is, while we still have a few old growth forests standing to study and compare with managed areas?

While foresters, taxonomists, and ecologists address the questions raised above, farmers, taxonomists, and soil ecologists need to examine similar questions in regard to VAM (vesicular-arbuscular mycorrhizal) fungi. VAMs associate with plants other than trees, predominate in grasslands, and are not visible without microscopes. Once again, their mushrooms represent the tip of a huge underground network. What is the impact of heavy machinery tillage, monoculture, and of pesticide and chemical fertilizer applications on these mycos and other biota of agricultural soils?

I thank Dr. Kris Pirozynski of the Canadian Museum of Nature and Dr. Ole Hendrickson of Forestry Canada, for helping guide an ichthyologist through the mycorrhizal network. Any errors are my own.



Biodiversity News Notes

UK Spurs Taxonomic Research

The U.K.'s National Environment Research Council (NERC) has announced it will provide £2.5 million for a five-year program to help re-invigorate taxonomy with higher education institutions. It plans to provide packages of support to three higher education institutions comprising:

- *NERC Fellowships in Taxonomy*
- *Research Grants*
- *Support for postgraduate students to attend established short courses.*

The successful institutions will be expected to provide evidence of a committment to teaching taxonomy and to develop collaborative links with taxonomic collections. The program follows the reports made by U.K. on the state of biosystematics and biodiversity and the opportunities provided by the latter, as well as active participation by U.K. in the Earth Summit.

Dr. Robert Anderson, Canadian Museum of Nature, receives National Geographic Society grant

Dr. Robert Anderson, research scientist in entomology from the Canadian Museum of Nature, has been awarded a National Geographic Society Research Grant for a project on leaf-litter beetles in Guatemala. The two-year grant of US$11,800 will cover the expenses involved in field expeditions to Guatemala in 1993 and 1994. The project is a collaborative effort between Dr. Anderson and Dr. J.S. Ashe of the Snow Entomological Museum at the University of Kansas. By studying the systematics and biogeography of leaf-litter beetles of limited mobility, Drs. Anderson and Ashe hope to provide information capable of assisting in pinpointing areas of high endemism and high biodiversity. Those areas are important for conservation in parks or nature reserves.

Permian-Triassic extinctions are associated with flood vulcanism and acid rain

It has been recently suggested that large-scale extinctions are associated with the dramatic outpourings of basaltic rock from volcanic events. Hot plumes from the earth's core may form giant disks with diameters of 2,000 km, resulting in flood vulcanism, and traps such as those in India and Siberia. A trap is dark-colored rock from volcanic eruptions with a columnar structure. Recent uranium-lead dating of the Siberian Traps closely match those for the Permian-Triassic boundary extinctions of 250 million years ago. Ejection of large amounts of volcanic dust and sulphur dioxide into the upper atmosphere, which is associated with those volcanic events, could have lead to global cooling, growth in polar ice caps, and acid rain. Permian-Triassic extinctions are best seen in the shallow water bottom fauna, associated with a period of rapid fluctuation in sea-level. [Campbell, I.H., Czamanske, G.K., Fedorenko, V.A., Hill, R.I. and Stephanov, V. 1992. Synchronism of the Siberian Traps and the Permian-Triassic Boundary. Science 258: 1750-1763].

Canadian environmental education network is formed

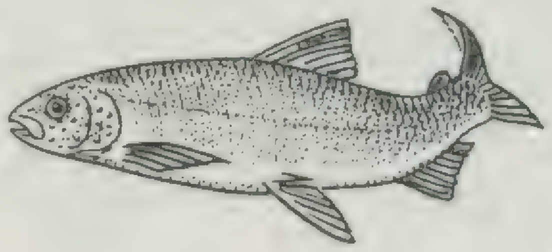
A National Environmental Education Network is being formed in Canada as a result of last May's MABNET (the Environmental Education Working Group of the UNESCO Canada's Man and the Biosphere Program) nation-wide survey. In the first year the Network plans to conduct a needs survey of the membership; assist regionally-based environmental education groups; support linkage of regional and international educational databases; publish a newsletter; publicize existence of the network; establish committees on relevant issues; produce case studies of successful programs; investigate the need for a national conference in 1994, as well as other related goals. For more information contact: Anne Camozzi, EcoLogic, P.O. Box 1514, Antigonish, Nova Scotia B2G 2L8, Canada. Telephone (902) 863-5984, Fax: (902) 863-9481.

Using chemicals instead of heat to dispose of toxins

Doug Hallet, President of Eco Logic of Rockwood, Ontario has just announced the development of a portable toxic waste destroyer. The system, which has received favorable reviews, breaks down toxins like PCBs without burning them - incinerating can produce potent dioxins and furans (heterocyclic hydrocarbons obtained from wood tar). U.S. Environmental Protection Agency tests show that the system can destroy heavy doses of PCBs in water, soil, and oil at an efficiency of more than 99.9999%, enough to meet Canadian and U.S. standards. [Ottawa Citizen, 11 April 1993, p. A11].

Rare vine may combat HIV

Leaves of a previously unknown vine from the rain forest in Cameroon contains a chemical that blocks production of HIV. Preclinical tests are being carried out to see if effective doses of the chemical are toxic; treatment based on the chemical is probably years away. The leaves of the vine contain an alkaloid called Michellamine B that inhibits replication of HIV according to laboratory tests at the National Cancer Institute in Frederick, Maryland, U.S.A., the U.S. government's top cancer research facility. The vine, representing a species new to science, is being called *Ancistrocladus korupensis*, after the Korup National Park where it was found. The park is located along Cameroon's northern border with Nigeria and is bounded on the south and east by a palm-oil plantation. If the park had not been set aside from development, the opportunity to discover this potential HIV remedy would have been lost. The plant was first discovered during a plant-collecting trip for the Missouri Botanical Garden in 1987. [The Globe and Mail, 7 April 1993].



Sponge extracts ease pain

Examination of 10% of rain-forest plants has produced numerous anticancer, antiviral and anti-inflammatory agents. The much higher phyletic diversity of biota from the oceans, scarcely investigated, promises even greater benefits. One example, amongst a flood of new ones, are extracts from sponge metabolites: manoalide, luffariellolide and scalaradial. All are powerful anti-inflammatory agents and apparently work through stimulating the formation of the prostaglandins and leukotrienes. The prostaglandins are well-known mediators of pain and inflammation, while the leukotrienes are involved in various immune reactions. [J. Mann, 1992, Sponges wipe away pain, Nature 358: 540]. Even considering the fact that sea life occupies 70% of the planet, its marine biodiversity deserves conservation for utility to humans around the globe.

■ ■ ■

Biodiversity Meetings

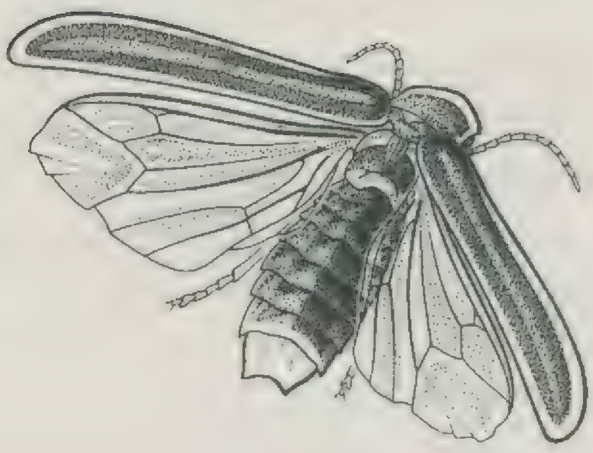
April 14-17, 1993. Conference on Global Ecology: Prediction of Ecosystem Responses to Environmental Change. Held in London, U.K. Contact: Commission of European Communities.

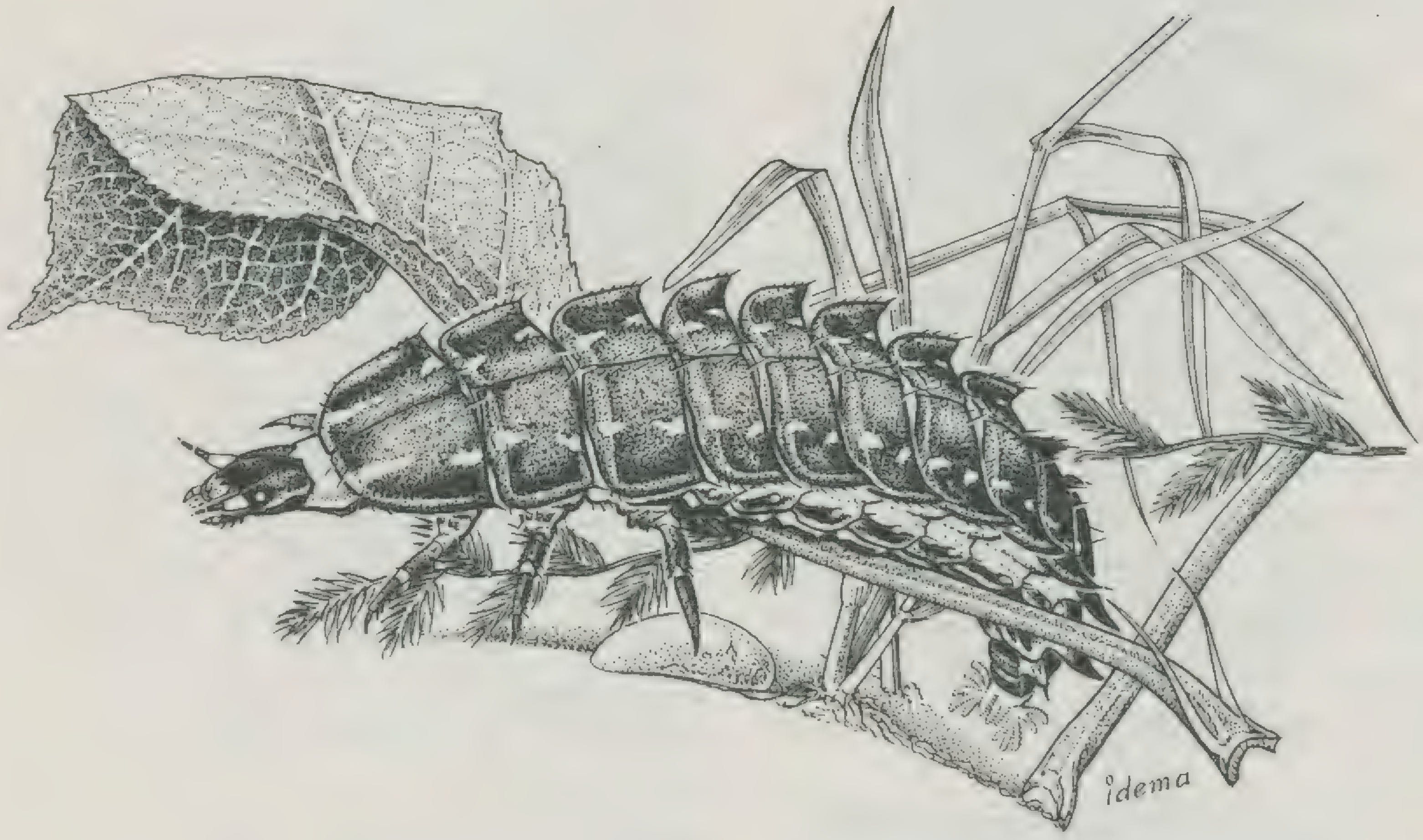
June 11-12, 1993. Atlantic Region Protected Areas Workshop. A workshop on "Protecting our natural heritage" will be held at the Forestry Complex in Fredericton, New Brunswick, to discuss system planning, ecological integrity, private stewardship, forest conservation, and biodiversity.

Contact: Eric Hundert, Environment Canada
15th Floor, 45 Alderney Drive
Dartmouth, Nova Scotia B2Y 2N6, Canada

November 2-5, 1993. The Inner Shores, an international workshop on introduced species in island ecosystems. Held in Queen Charlotte City, British Columbia. Contact:
Coordinator Inner Shores
Box 867, Queen Charlotte City
B.C. V0T 1S0, Canada

Firefly





Walking along a country laneway on a summer night, the Editor noticed a tiny flashing light on the ground appearing and disappearing through bits of grass and leaves. Capturing one of 'the lights,' he could see a tiny blue-green light shining from the end of the abdomen. It was a firefly larva, and it is hereby illustrated above. The specimen, collected near Perth, Ontario, is the larval form of an unidentified species of firefly in the genus *Photinus.* Firefly larvae are predaceous and feed on other insects, snails and slugs. There are 29 species of fireflies, or Lampyridae, known from Canada.

Firefly beetles are well known because of the ability to produce flashing light. The color of the light and the number and duration of the flashes are characteristic for each species, and allows the two sexes to find a mate of the same species. Most adults and all larvae are luminescent. Firefly light is produced by two compounds: luciferin and luciferase. As these chemicals react they produce yellow-green light but very little heat (unlike our electric lighting). Recently, luciferin and luciferase have been used to 'mark' tuberculosis bacteria for early detection and treatment. Some larger tropical fireflies mimic the flash patterns of smaller species. They they catch and eat the unsuspecting individuals that they have lured. [Information from Dr. Robert Anderson, Entomologist, Canadian Museum of Nature]

Book and Periodical Niche

Global warning...global warming

Melvin A. Benarde, 1992,
John Wiley & Sons Canada, Ltd., Etobicoke, Ontario,
317 pp., $41.95CAN (cloth), ISBN 0 471 51323-7.

If we have difficulty predicting local weather even a few days ahead of time, how can we rely on computer model predictions of global climate for several decades from now? A cautionary approach of this sort is worth keeping in mind when confronting the current global warming question—one attributed to the massive generation of "greenhouse" gases by people. In fact, there is no consensus that detectable global warming has occurred yet, and predictions of global warming are still highly uncertain. For example, it is particularly difficult to adequately account for basic elements like clouds in climatic models.

Nevertheless, it is worth paying attention to Melvin Benarde's thorough and balanced discussion of global warming. Benarde, a professor of environmental sciences at Temple University, has written several other books on environmental hazards. The writing is at about the senior high school level, and besides being of interest to the "educated layman," the book would make a fine, challenging text for an integrated science course.

There are five main parts to the book. The first chapter deals with some basic reasons for changing seasons and climate: the Earth's tilt, orbital eccentricity, and the precession of the equinoxes. The following chapter is about the nature and composition of the atmosphere and the balance of gases within it—particularly 'greenhouse' gases such as CO^2 and chlorofluorocarbons (CFCs), which are identified as prime contributors to future global warming.

The discussion shifts to models and their use in predicting global warming, and considers the possible results of such warming. Benarde pulls no punches about the risks involved should decision-making based on computer-generated climatic models be wrong, and correctly stresses the great political problems in acting to try to counteract global warming. After all, political parties often are not in power longer than five years, and the greatest impact of greenhouse warming may not occur until well into the next century!

Chapter four deals with environmental dislocations stemming from climatic model predictions (several different models can be used). As Canadians, we should be aware of the consequences of a relatively rapid sea level rise in our low-lying coastal provinces like Prince Edward Island (e.g., Climate Change Digest 88-02 of Environment Canada). Further, there is some evidence that storminess would increase as a result of CO^2-induced global warming. Benarde notes that a combination of low-lying land and proneness to cyclones would make Bangladesh particularly susceptible. Despite possible problems, potential benefits could arise if global warming occurs as predicted. In northern Canada, for example, navigability of Arctic waters could be greatly enhanced. Near the end of this chapter, Benarde gives a "best estimate of a mean global warming of 1.8°C by 2030."

The final chapter offers a menu of realistic 'solutions' that would help to reduce energy consumption (and therefore greenhouse gases) in technically advanced countries. Benarde states that it is sensible to avoid abrupt curtailing of fossil fuel use that would produce global economic and social instability, but at the same time he advises us to improve energy efficiency by greater use of mass transportation, hybrid electric vehicles, hydrogen fuel cells, natural gas (British Columbia is given a pat on the back for its enlightened promotion of this fuel), and solar and hydro power.

The book is well-produced, has a good index, and a useful 13-page glossary. Pertinent references are listed at the close of each chapter. Pictures and diagrams are used effectively. An exception to the careful editing is the statement in both Glossary and Appendix that the Pleistocene epoch lasted to 100,000 years ago, rather than 10,000 years ago. I highly recommend this book for its carefully researched, sensibly balanced approach to an often sensationalized subject.

C.R. Harington, Paleobiology, Canadian Museum of Nature, Ottawa, Ontario, Canada

Seeing the forest among the trees ~ the case for wholistic forest use.

Herb Hammond, 1991,
Polestar Press Ltd.,
P.O.Box 69382, Station K,
Vancouver, B.C. V5K 4W6
309pp. Softcover, ISBN 0-919591-58-2
$46.95.

This is a truly remarkable and radical book on forestry; remarkable in the pictorial scope and depth of subject matter covered, radical in its scathing attack both on the timber companies of Canada (especially those of British Columbia) and on gullible or complicitous governments, which in practising "sympathetic administration" have given away the use of public lands for a song . The author, a registered professional forester and consultant with a Masters' degree in ecology and silviculture, knows whereof he speaks. In defense of non-exploitive ethical forestry he has taken his licks from the establishment, which on several occasions has attempted to unfrock him. Despite his duelling scars — the unkindest cut being the accusation of transgressing professional ethics — Hammond's tone is constructive and conciliatory as he probes the current forest-destroying system. The goal of this system is quick profits, and it achieves this end by the liquidation of old growth forests by "least-cost logging," which can be translated to "cheap clear-cutting." Under the rubric 'Wholistic Forest Use,' he advocates an alternative position of forest care, ecological land-use planning, old growth forest protection, and ecosystem landscape restoration.

The inspiration for his 'New Forestry' philosophy is the conviction that humans need forests and have always been spiritually bound to them. In a profound and essential sense, forests are an animating vital source necessary for the health of the world and for our own well-being. Like many other nature lovers, Hammond was deeply affected by an early experience when he felt a "oneness" with the ancient forests near his home in Oregon. Love of the forest and awe at its mystery and majesty permeate the book and shine through its many beautiful pictures. His empathy with the forest and his sense of its other-than-human importance has been sharpened and refined by association with the indigenous peoples of western Canada. Their philosophy, to which he subscribes, is briefly summarized in three instructions:

(1) Love the forest and give thanks for the sustenance it provides,
(2) Protect all parts of the forest while using it wisely,
(3) Trade or barter the excess bounty of the forest.

Endorsed by Chambers-of-Commerce, industrial forestry scorns such sentiments, clashing as they do with conventional Euro-American culture. Have we not transcended nature? Are we not God's stewards, the bosses, the entrepreneurs, the disciples of economic growth, the fabricators of excess wealth? City folk in their International Style, steel-and-glass towers surrounded by computer screens have little incentive to love the forest, to protect its parts, and to free-trade only its excess periodic interest. Rather their inclination is to whack down the trees, sell the raw wood, and invest the

money elsewhere. Hammond describes how forests on both public and private land are slaughtered, soil degraded, watersheds ruined, animal habitats destroyed, species extinguished, and aboriginal land rights ignored. By way of atonement, the destroyers argue provision of jobs, better business, global market demands, more foreign exchange, positive balance of payments, and the planting last year of X million trees.

In essence, what is called "forestry" in Canada and the U.S.A is the "high-grading" of whole landscapes, the destruction of complex forest ecosystems and their replacement with simplified counterfeits: artificial plantations of vertically standing logs whose sole purpose is fiber production. By converting the old growth forests of the world to short-rotation plantations the art of extinction is perfected. The goal is not preservation but pulp; not creative forest ecosystems but fiber farms for short-term gain; not long-term planning but expedient patch-up tactics that signify ecological ignorance and disdain for Earth. Hammond eschews tinkering with the current system; he advocates the shift to a new paradigm that marries heart and mind, that merges spiritual values with ecological realities.

Genuine forestry ought not to be merely the first industrial step toward meeting the demands of log supply depots, but rather the care of and ministration to forested landscape-waterscape ecosystems. What this radical change-over involves is carefully explained in its many dimensions of school and university education, comprehensive land-use planning, long-term horizons for planning (for example, allowing forests to complete their full life cycles rather than cutting on short economic rotations), zoning for preferred uses (timbering as the most intrusive activity comes in last, as it should), legislation, government facilitation, extension, land ownership, community control, consensus building, along with a host of other topics including the preservation of biological diversity. The latter is a central theme, clearly related to the necessity of planning spatially the non-uses and uses of landscapes. Planning horizons must be hundreds of years ahead to ensure that native ecosystems are maintained with ample nodes and connecting corridors — the preserved natural matrix within which careful human uses can safely be practiced.

The book is dense with facts, personal experiences, and novel, practical ideas, and the whole is imbued with a profound sense of conviction and dedication. Hammond is sensitive to the meaning of words and phrases: who, for example, are the "forests pests" — insects or people? An excellent index gives the reader ready access to the broad range of subjects described in five sections of text: I. What are Forests? II. How do we use the Forest? III. What are the impacts of our use of the Forest? IV. The politics of Forest use. V. The solution — Wholistic Forest Use. A fine summary/Photo Essay concludes the book, which overall is a superb artistic creation with good content, clear print type, and excellent photo reproductions. Other subtle touches such as, the use of a Slocan Valley artist's handmade paper for the frontispiece of each section enhance the book, too.

Here is a work from which all can benefit: school students, the lay-person desiring a quick education in "natural resource" matters, the bureaucrat and professional wanting to be brought up to speed on "Wholistic" or "New" Forestry, and of course, Earth-lovers in general. Obviously this reviewer thinks it is great. Too bad it isn't cheaper, but then good things are frequently expensive. If money is short, two or three or four people should get together and jointly buy an invigorating copy.

J. Stan Rowe, New Denver, B.C., Canada.

Kimberley rain forests of Australia.

edited by N.L. McKenzie,
R.B. Johnston and P.G. Kendrick. 1991.
Surrey Beatty & Sons, Pty Limited,
Chipping Norton, New South Wales, Australia, 490 pp, bibliog. + index.
Hardcover, ISBN 0 949324 37X. AUS$70.20.

Rain forests, as conventionally defined, describe forests of the perhumid tropics that are evergreen, hygrophilous and at least 30 metres high, rich in thick-stemmed lianas and in woody as well as herbaceous epiphytes. In this regard, Australia is not often thought of as a place of rich tropical rain forests.

Australia has a mere 1.6 million hectares of tropical rain forest and about 0.5 million hectares of temperate rain forest. This is a total area, and it is less than the area cleared in the Amazon rain forest basin each year. It is, therefore, somewhat surprising that an area in the remote northwestern part of Australia, a region known as the Kimberleys, was the focus of study. In 1986 15 Australian scientists began a three-year investigation of scattered patch-like remnants of what was once a more extensive monsoon rain forest region.

McKenzie, Johnston and Kendrick have edited 21 refereed chapters that comprise this beautifully presented volume. At the very start the editors redefine the term "rain forest," expanding its otherwise narrow interpretation to include "monsoon forests (or semi-deciduous vine thickets) that are distinguished from 'evergreen' forests as more or less leafless (deciduous) during the dry season, 'raingreen' during the wet season, less lofty than 'evergreen' rain forest and lacking woody epiphytes."

The Kimberley rain forests are a part of the dry "monsoon" rain forest mosaic, which expands through areas of Australasia that are seasonally dry. In Western Australia about 1,500 patches of "raingreen" areas extend northward from the Great Sandy Desert to the wetlands and remote rugged escarpments of the sub-humid, north Kimberley. The editors are quick to point out that remote does not imply pristine, as the area has suffered somewhat from the 40,000 years of aboriginal and European exploitation. The megafauna, in particular, has been decimated.

Worldwide concern for tropical rain forests increased during the early 1980s. Just before then methods of study and state-of-the-art research techniques in sampling and analysis had provided scientists with new tools to carry out research in otherwise inhospitable areas. It was this concern and urgency that prompted the Department of Conservation and Land Management (CALM), with funding from the Australian National Rain forest Conservation Programme, to undertake the three-year study to increase knowledge of Western Australia's tropical rain forests.

The 21 chapters of this book cover aspects of general ecological surveys, remote sensing of rain forest patches, floristics and phytogeography, soils and landform surveys, and detailed lists of individual animal groups (earthworms, snails, scorpions, ants, spiders, beetles, reptiles and amphibians, birds and mammals) and also lists plant groups. The book culminates in an integrated, quantitative analysis of the ecology, biogeography, and conservation of the complex, intricate, and fragile rain forest communities.

The book is intended as a reference source for future research in the Kimberley rain forests, including monitoring and management programs. The large format (20.5 cm x 29.5 cm) and easy-to-read large print, make this book a ready reference source. Sixty-one color and 18 black and white plates provide the reader with adequate photographic documentation of all aspects of the study. With these attributes, this book will survive for many years as the source of data and interpretive investigations on the little-known, yet now re-discovered, Kimberley "raingreen" forests. The individual authors and the editors are to be congratulated for their dedication and efforts.

David M. Jarzen, Paleobiology, Canadian Museum of Nature, Ottawa, Ontario, Canada

Breeds & breeders. A guide to minority livestock breeds in Canada

Joywind Farm Rare Breeds Conservancy Inc.,
General Delivery, Marmora, Ontario K0K 2M0, Canada.
1992. 125 pp., illus. Softcover, ISBN 0-0696377-0-5.

Humans have been breeding livestock for thousands of years in the Old and New Worlds. This has resulted in a great variety of breeds adapted to local conditions or local needs. The development and commercial promotion of high yield breeds for meat, milk, wool, and other purposes, is displacing some of these breeds in their country of origin and elsewhere. The preservation of rare breeds is important to meet future human needs, for cross breeding, for esthetic reasons and as part of our heritage. Because low producers unlike high-producers, often do better under harsh environments, as genetic reservoirs for disease resistance and other qualities, it is vital to ensure their survival.

This book reports on 11 breeds of cattle, 15 of sheep, 6 of horses, 6 of swine and 2 of goat. Each account includes a photo of the breed, information on its history, color, size/weight, characteristics, uses, breeding notes, and a list of breed societies and breeders in Canada.

The 50 rare breeds in Canada described here include the following:

- Kerry cattle are a remnant of the Celtic Black cattle, which originated in central Asian in the fourth century and were the dominant cattle in Ireland up to the end of the 17th century. Eleven heifers and one bull were imported into Canada in 1971 to start a herd.
- Barbados Blackbelly sheep are reddish brown with the underside of the belly and lower legs entirely black. Bred for meat, they lack wool and horns. They were introduced into Barbados from West Africa over 300 years ago.
- Newfoundland Ponies are usually bay and stand about 12 to 14 hands high. They have sturdy feet and legs and seldom go lame. Used for hauling boats out of water, pulling logs from the forest and preparing land for spring

planting, they have good temperment, good memories, and are hard workers.

This is a fascinating book about rare breeds being kept in Canada, and the value, approaches and projects being undertaken. I have described only part of the information packed in this book.

Don E. McAllister, Canadian Centre for Biodiversity, Canadian Museum of Nature, Ottawa, Ontario, Canada

BIOPOLICY INTERNATIONAL 4. Intellectual Property, Biotechnology and Trade: The Impact of the Uruguay Round on Biodiversity.

Acharya, Rohini. 1992.
ActsPress, P.O.Box 45917, Nairobi, Kenya.
27pp. Paperback, US$ 7.50. ISBN 9966-41-040-6

Intellectual Property, Biotechnology and Trade is a discussion of issues surrounding intellectual property rights (IPRs) associated with biotechnology. IPRs are legislations protecting or rewarding the originators of ideas and inventions in the form of patents, royalties, exclusive use, or ownership. Trying to balance acknowledgement of the innovator and the economic application of the concept, especially considering the North-South (N-S) economic and technological imbalance, is very difficult.

The book examines the influence of IPRs on technological evolution and discusses the history, influences, and complexity leading toward the inclusion of IPRs in international trade agreements such as the Uruguay Round of GATT. The relationships between biodiversity, biotechnology, and IPRs are explained, and the use of public domain knowledge is urged.

The book is poorly organized, and unfortunately, the author's arguments and positions are not clear. The title implies an emphasis on the impacts on biodiversity, yet trade, economy, and technology seem to be the major focus. The discussion is dominated by the interests of the developed countries and industries, and the voices of the natural world (biodiversity) and lesser-developed countries are heard only faintly. If this reflects the actual voices heard at GATT, this is cause for alarm.

Technological innovations require a substantial investment in background knowledge and forefront research, involving much effort and commitment, which makes it harder for poorer countries to compete. With the implementation of an IPR regime, the new knowledge would be locked within the industrialized countries, furthering the N-S economic and technological inequality.

The book offers a solution to this inequality by encouraging the use of public domain knowledge, knowledge not restricted by ownership. Biased toward developed countries, this solution would leave the poorer countries out of initial developments that are not yet in the public domain. Perhaps presently, innovations can be obtained by using public domain knowledge without much effort, financial investment, or expertise . But if an international IPR regime is agreed upon in the future, more knowledge will be protected, resulting in less current, public domain knowledge and causing a longer technology lag in the poorer countries. The countries leading the research and development would be the ones determining the direction of further research. Poorer countries, not at the forefront of research, would have less say in the direction of innovation. Duplicating pre-existing technology and research would be a waste of time and resources. The N-S balance, a major issue at the Earth Summit, would tip to further inequalities with these factors.

The impact of an IPR agreement on biodiversity, not covered in detail in the book as implied by its title, would depend on the specifics of the agreement. Biodiversity, which provides new genetic material, must be preserved in the interests of biotechnology. Increased biotechnology research and application cause a decrease in biodiversity, yet require an increased resource of new genetic material. Stresses on living resources such as increasing temperatures, ultraviolet light, pollution, and decreased habitats would demand more resilient species, perhaps procured through genetic engineering.

The book concentrates on the need to compensate the countries housing the biodiversity, mostly developing countries, and does not dwell on the basic idea of the global threat to biodiversity, not caused by biotechnology. If the book were better organized and more readable, this lack of doom-preaching would be a relief from this common theme in literature and media these days.

Even so, the economic world must acknowledge that biodiversity provides ecological services for life-support of the planet, resources, such as new genetic material, for biotechnology, and raw materials for industrialized countries, all with large price tags attached. Maybe the saying, "Money makes the world go round" has been replaced by "Biodiversity makes the world go round" as awareness of the threat to biodiversity grows. Perhaps, the focus of GATT is too narrow, concentrating on economy, development, and trade, and should include the preservation of biodiversity in its agenda, stressing the world's dependence on it.

Just as a doctor is morally obliged to share his knowledge to alleviate the suffering of humans, shouldn't innovators be morally obliged to share knowledge, which might improve aspects of life? For instance, shouldn't research that could be expanded and applied medically or environmentally to save lives be shared? Just as reward to the innovator must be discussed, the right of humanity to the innovation's benefits should be acknowledged. Before an international IPR policy is finalized, all issues must be examined and discussed thoroughly — with all voices being heard fairly.

Rhiannon Johnson, 4084 West 31st Avenue,
Vancouver, BC, Canada

A complete checklist of the birds of the world

Richard Howard and Alick Moore. 1991.
Academic Press 24-28 Oval Road, London NW1 7DX, U.K. or San Diego, California, U.S.A. 92101. 622 pp. Second edition. Hardcover ISBN 0-12-356910-9.

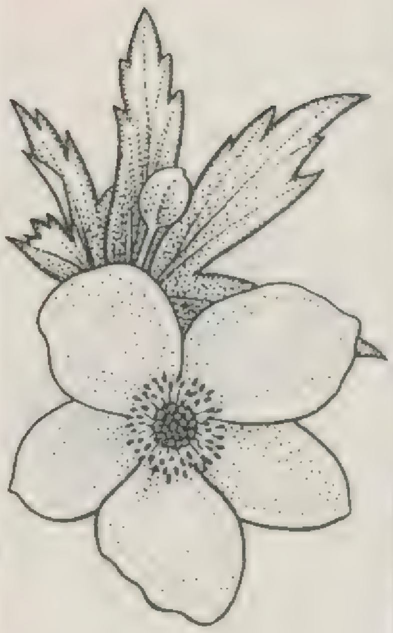
The second edition of this book lists more than 9,200 species of birds. While 24 new species and 34 genera have been described or revived, lumping has meant that there has been a decrease of 51 in the number of species and 14 in the number of genera recognized. This contrasts with the lower vertebrates and especially invertebrates where there are substantive net gains in number of taxa, and there are clearly significant percentages of new taxa yet to be described. The bird species are listed under an established classification system with the species scientific names in boldface and subspecies in regular type. An English common name is given for each species, and a very short range statement is given for each species or subspecies. Indices of Latin and English names are given separately.

50 simple things your business can do to save the Earth

The Earth Works Group, Earth Works Press, Inc., 1400 Shattock Avenue, Box 25, Berkeley, California, U.S.. 94709. 120 pp. Paper, ISBN 1-879682-02-8. Can$8.95.

Some environmental books are preachy, some are practical. This one is very practical. The book presents 50 ways that a business or other organization could use to save the Earth. Under catchy titles, such as Just the fax, Don't be a drip, Set up a Green Team, ways to save the environment and, at the same time, save or make money for the business are discussed. Concepts include reducing packaging, use of fluorescent lights, getting better car mileage, turning off office machines when not in use, giving away instead of throwing away old furniture, reducing heating and air conditioning costs. The environmental basis is explained for each idea, simple instructions are provided for doing it, success stories are given for companies that did it, under the bottom line are given the advantages for the company, and lastly the sources for resources are given - these may be companies, government agencies, or books. This book is highly recommended for anyone in an organization that wants to help the environment and reduce costs.

Don E. McAllister, Canadian Centre for Biodiversity, Canadian Museum of Nature, Ottawa, Ontario, Canada



Environmental risks from the release of gentically modified organisms (GMOs) - the need for molecular ecology

M. Williamson. 1992. Molecular Ecology 1: 3-8.

Applications to release genetically modified organisms (GMOs) into the environment, usually the agricultural environment, are increasing exponentially. Many involve crop plants that are also weeds. Studies of biological invasions and of biological control show that the probability of a genetically new organism establishing itself is small; it is also unpredictable and, in some cases, could have severe ecological effects. GMOs pose risks both because they will be released in large numbers and because the greater the genetic novelty, the greater the possibility of ecological novelty. Molecular ecology is an essential ingredient in ensuring that risks are assessed efficiently. [Author's abstract].

Biology International

The News Magazine of the International
Union of Biological Sciences (IUBS).
IUBS Secretariat, 51,
Boulevard Montmorency, 75016 Paris, France.
Free to Ordinary and Scientific Members,
US$40 for other individuals.

The January 1993 issue, Number 26 of *Biology International* contains considerable biodiversity information of interest. This includes reports on the Human Genome Initiative, the Decade of Tropics Programme, global change and ecological complexity, biodiversity and wheat improvement in China, the Commission for Biological Education, a report on Diversitas and the VIIth International Congress on Culture Collections and the First World Congress on Medicinal and Aromatic Plants for Human Welfare (WOCMAP). A publications review and calender of meetings section completes the news magazine. Diversitas is the name for the IUBS/SCOPE Programme on Biodiversity.
It includes three programme areas:
1) ecosystem function of biodiversity;
2) origins, loss, and maintainance of biodiversity;
3) and inventorying and monitoring of biodiversity, as well as the cross-cutting marine and microorganism biodiversity.

Numerous countries and private sectors have shown interest in these programs. Judging by this issue, *Biology International* is a very useful periodical for those interested in global aspects of biodiversity.

Don E. McAllister, Canadian Centre for Biodiversity, Canadian Museum of Nature, Ottawa, Ontario, Canada

A global partnership

Canada and the Conventions of the United Nations Conference on Environment and Development (UNCED).
The Honourable David MacDonald, Chairperson,
Report of the Standing Committee on the Environment, House of Commons Canada.
Issue No. 62. 133 pp. April 1993.

The Standing Committee on the Environment of Canada's House of Commons undertook to review the implications of the conventions signed at the Earth Summit in Rio. They examined the articles of the conventions and many other documents, called in expert witnesses, deliberated on the evidence, and produced this report with 27 recommendations to the House of Commons with a request for a response. The Committee was also instrumental in Canada's decision to be one of the earliest ratifiers of the Convention on Biological Diversity.

The results of the Committee's hard work and deliberations are impressive and deserve to be widely read. Recommendations include:

- that the Rio Way (transparency, inclusiveness, and accountability) become established as the fundamental process for decision-making and policy development;
- that Canada meet the Agenda 21 target of 0.7% of GNP for Official Development Assistance by the year 2000;
- given the importance of Canada's scientific resources and expertise in meeting Biodiversity Convention obligations, that the Government examine the feasibility of re-grouping agencies and professionals working in the area of biodiversity in various federal departments to ensure effective communication and networking;
- develop a National Inventory of Canada's Biological Diversity and an international data bank of the world's species;
- ensure sufficient support of institutional research into the study of the species of flora and fauna that make up the diversity of life;
- design economic instruments for biodiversity conservation and review government subsidies, policies, and programs that contribute to environmental degradation;
- complete the networks of protected areas representative

of Canada's land-based regions by the year 2000 and accelerate protection of marine natural regions;

- adopt frameworks, strategies, and time frames for completion of protected areas networks;
- develop an integrated legislative approach to the protection of endangered species, habitats, ecosystems, and biodiversity in Canada;
- move toward a corporate average fuel economy standard of 7.2 liters per 100 km for passenger cars;
- accelerate Canada's program to develop an effective package of economic instruments with which to combat greenhouse gas emissions; and
- encourage the use of public transportation systems.

These are précis of some of the recommendations and I recommend that the reader obtain a copy of the full report, with all its evidence, from Norman Radford, the Clerk of the Standing Committee on the Environment, House of Commons, Parliament Buildings, Ottawa, Ontario K1A 0A6. The Committee is to be congratulated on its report, *A global partnership.*

Don E. McAllister, Canadian Centre for Biodiversity, Canadian Museum of Nature, Ottawa, Ontario, Canada

How to press flowers

Video produced by the Canadian Museum of Nature, Publications Division, 1993. Distributed by RK media consultants, 107 Berkley Rd., Cambridge, Ontario, Canada, N1S 3G8. In the U.S., P.O. Box 2512, Buffalo, NY. 14240-2512, U.S.A. Length: 25 minutes. ISBN 0-660-1370-X.

In this video, museum experts show how to press flowers and what materials and equipment are needed. The techniques are useful for pressing botanical specimens for scientific research or pressing flowers for esthetic purposes. You will also receive tips on collecting in the field, and step-by-step instructions for building your own plant press.

Earth in the balance. Ecology and the human spirit.

Senator Al Gore. 1992. Houghton Mifflin Company, Boston, New York, London, 215 Park Avenue South, New York, N.Y., U.S.A. 10003. 407 pp., illus. Hardcover, ISBN 0-395-57821-3. CAN$29.95.

This book provides provocative, creative, and knowledgeable thinking on the state of the Earth by a man, who after he wrote it, has become Vice-President of the United States. Underlying the book is a long-term involvement in environmental issues and several initiatives to bring environment into the American political agenda. This book makes clear statements on where we are, how we got there and what we should do about it.

Clear evidence for threats to the state of the Earth is brought forward: simple, clear, and authoritative graphs on the global increases in carbon dioxide, loss of species and human populations. Dramatic photos, such as those of marooned ships in the drying ocean bed of the Aral Sea, convince the reader of the reality of the concerns. A rich variety of recent and historic examples help the reader understand that the concerns about the Earth are not theoretical but can have real impacts on the environment and on society.

Earth in the balance also analyzes the socio-economic reasons underlying our plight, and options for solving the problems. In proposing options, Gore offers practical successful examples of mechanisms that solved international dilemmas in the past. He proposes a Global Marshall Plan, based on the success of the Marshall Plan that helped revive Europe after the devastating Second World War. This new Global strategy would include: targetted literacy programs where the demographic transition to moderate population growth has yet to occur; programs to reduce infant mortality and increase survival and excellent health for children; ensure that birth control devices and techniques are made ubiquitously available along with culturally appropriate instruction. Other recommendations are made and include developing/sharing appropriate technology, developing economic tools that encourage sustainability, shifting financial resources from the insane use in purchase of military weaponery to environmental and humanitarian use, and introducing a tax on carbon dioxide production to create an Environmental Security Trust Fund.

This is a creative, lively, and practical manual for helping restore the Earth's balance and the human spirit. It is a good read. It is a hopeful sign when political leaders focus their energies on knowledge, profound thinking, and compassion for all life, as well as on media image.

Don E. McAllister, Canadian Centre for Biodiversity, Canadian Museum of Nature, Ottawa, Ontario, Canada

Old world fruit bats, an action plan for their conservation.

S. P. Mickelburgh, A.M. Hutson and P.A.Racey (compilers). 1992. IUCN World Conservation Union, Information Press, Oxford, U.K. ISBN 2-8317-0055-8 252 pp.

This book presents a comprehensive review of old world fruit bats, the species in the family Pteropidae, suborder Megachiroptera in eight chapters and three appendices. It also includes a selection of photographs that remind the reader about the appearance of the animals under discussion.

The first chapter introduces a variety of information about the bats, while Chapter 2 provides a specific catalogue of the family Pteropidae. The third chapter, which makes up almost 50% of the book, is devoted to individual species accounts. Centers of biodiversity are discussed in Chapter 4, and Chapter 5 presents a series of recommendations for action to conserve threatened fruit bats. The latter chapter proceeds from general issues of habitat conservation to specific issues in more restrictive geographical areas, usually countries. The sixth chapter discusses survey techniques for fruit bats, Chapter 7 addresses issues of captive breeding and translocation, and the final chapter catalogues 20 high priority projects.

Appendix 1 lists plants used by fruit bats. Appendix 2 identifies the geographical units used in the biodiversity analysis, and Appendix 3 describes the geographical distribution of the fruit bats.

I like this book because it provides specific recommendations that can serve to focus the energies, activities, and resources of people and organizations that want to do something for old world fruit bats. The book makes it clear that although we have learned a good deal about these bats, we still do not know much about their basic biology. This same ignorance, of course, also applies to most other organisms.

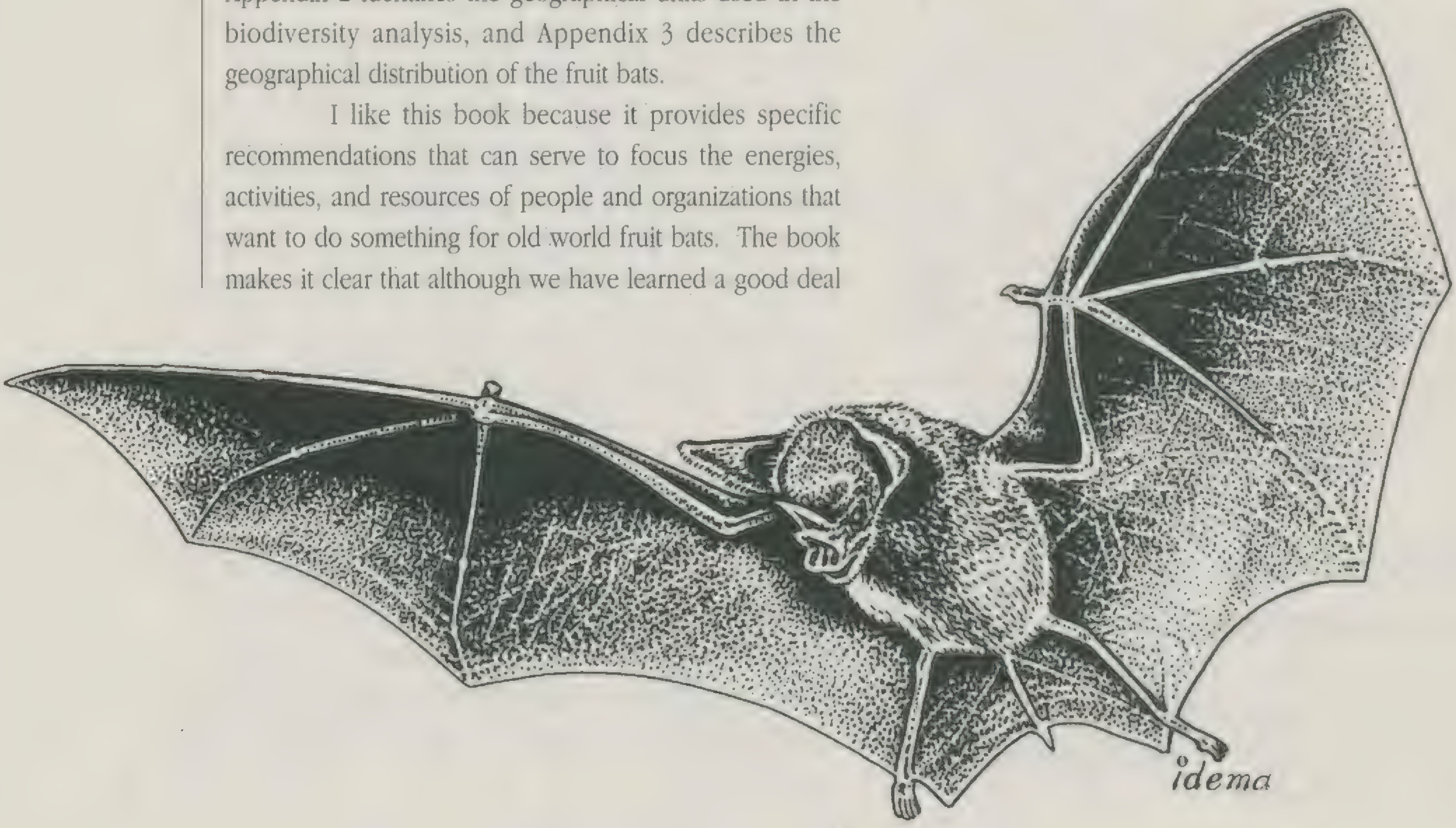
In the final analysis, habitat destruction, human misconceptions, and our lack or knowledge combine to present the most pressing threat to most bats, including most species of Old World Fruit Bats. But island populations of some species of Old World Fruit Bats are an important exception to this generality. This book documents the impact that human predation has had on some species of flying foxes, and thus, provides still more examples of humans hunting other species to and beyond the brink of extinction.

Everyone who studies bats will want a copy of this book.

M.B.Fenton, Department of Biology, York University, North York, Ontario, Canada M3J 1P3.

ERRATUM

The Scientific Editor apologizes for identifying the book reviewer of Mushrooms of Western Canada as K. Pirozynski in Canadian Biodiversity 2 (2). The reviewer's name should have been Yolande Dalpé, Programme Chief, Mycology, Agriculture Canada.



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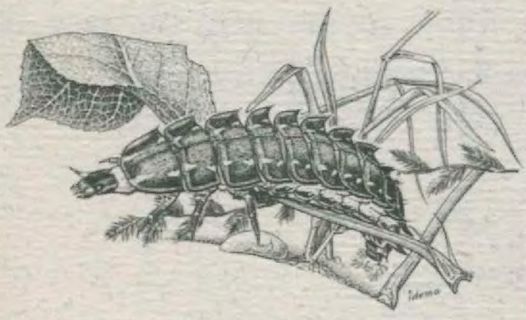

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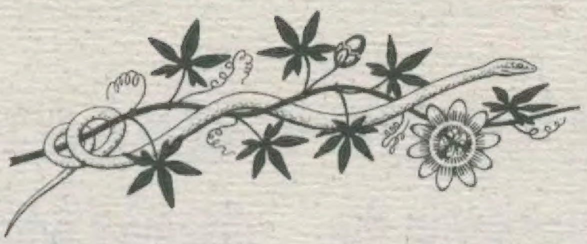


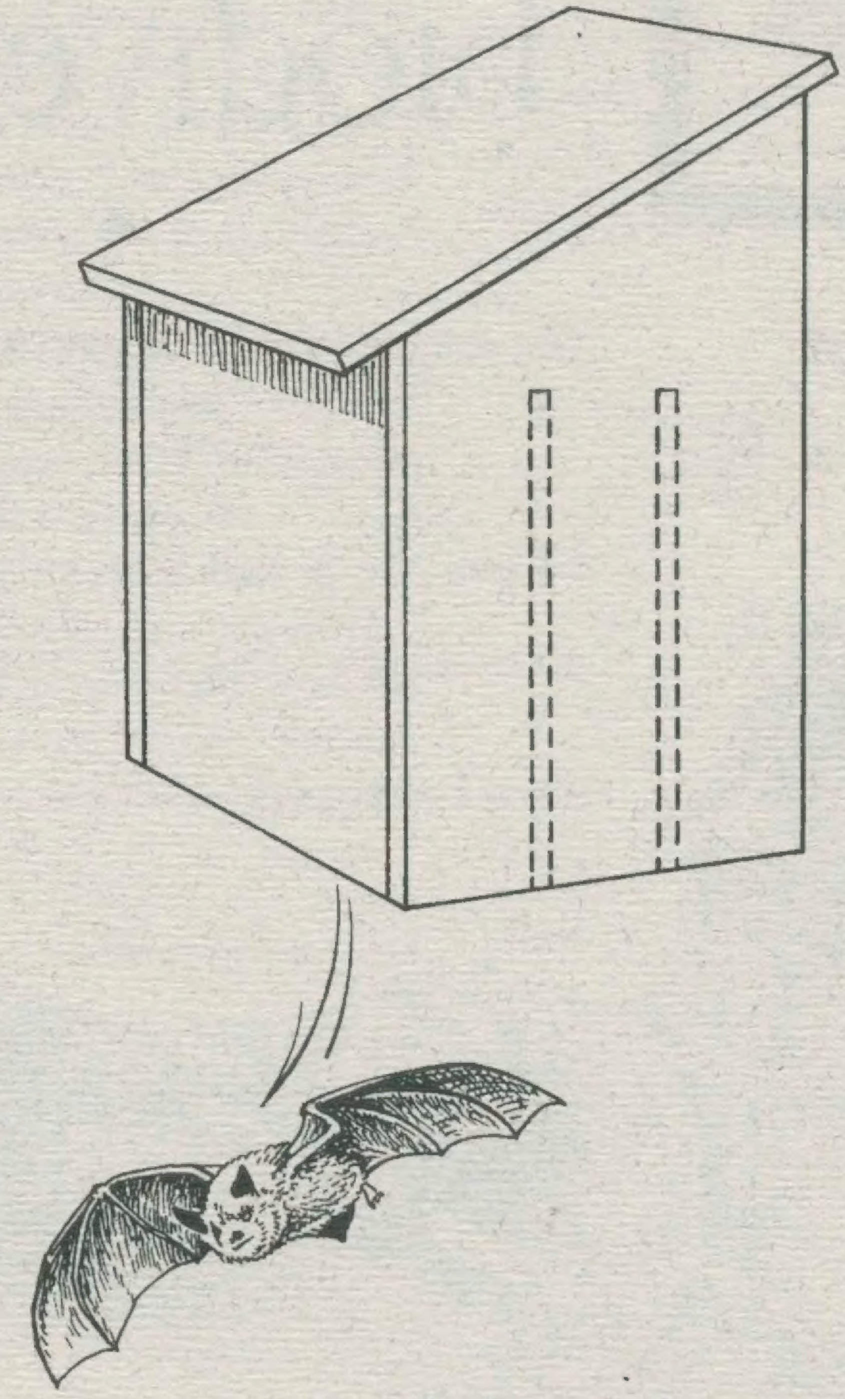
Help bat conservation:

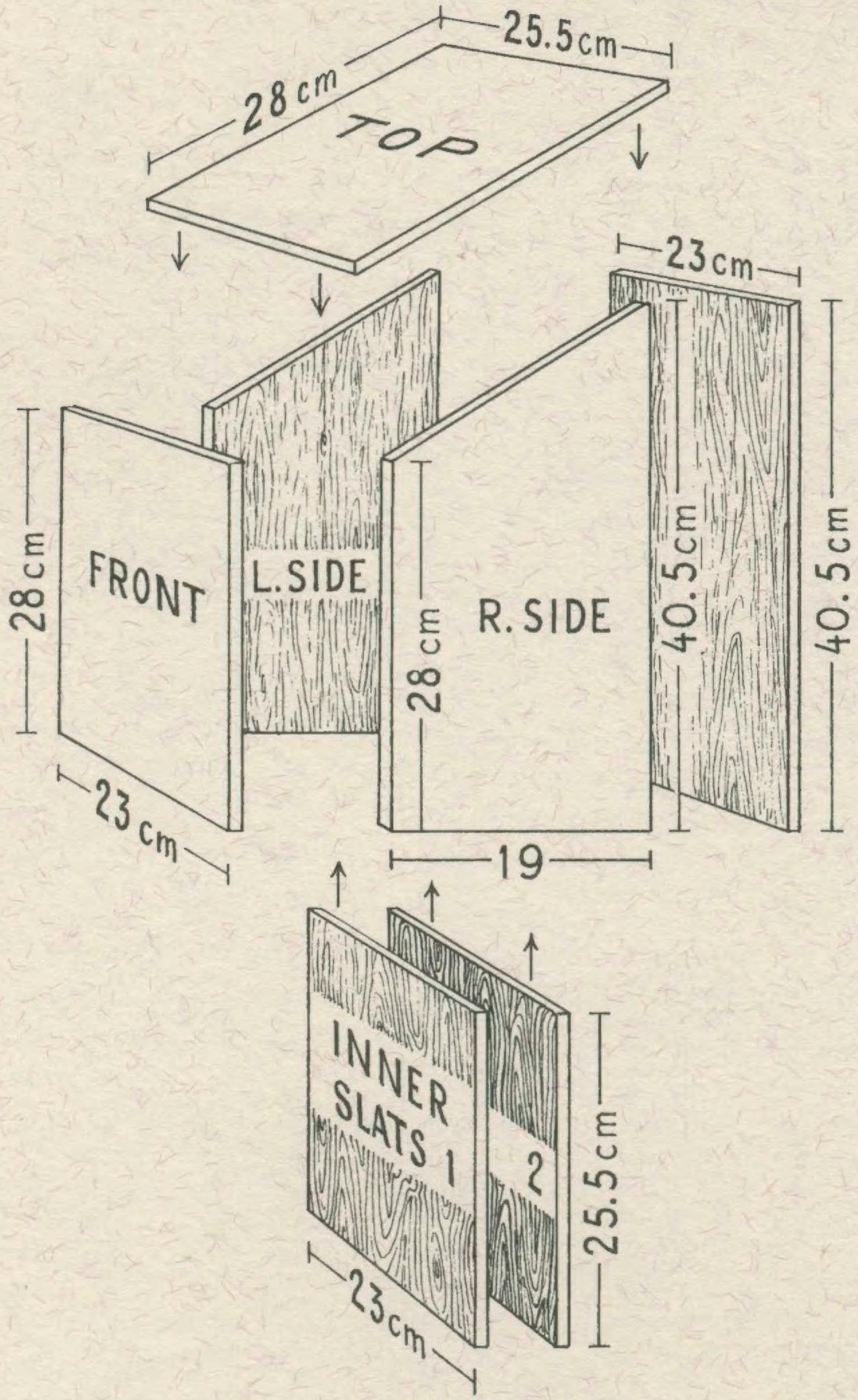
Build a bat home

Bats should be encouraged, not feared. In temperate areas they are insectivores, and as such, offer a beneficial service to humans. Witness the Little Brown Bat, the most common species in Ontario, which is known to eat large numbers of mosquitoes. Why not give bats a home in your backyard?

However, please note, that although bat houses are widely available, there is little evidence that they are being used.

A bat house is easy to make. All you need is: rough-cut cedar planks (not plywood); wood screws; a sheltered spot, with a southwestern exposure, in which to place the finished house; and some time.





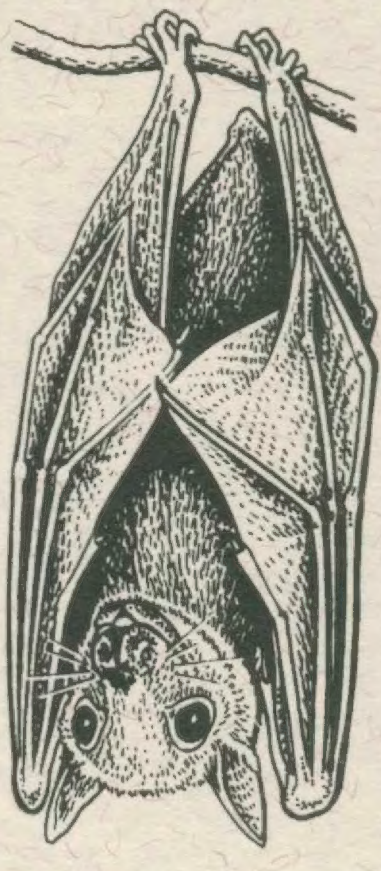
Here's how:

1. Cut the cedar planks to match the dimensions in the diagram.

2. After ensuring that the rough-cut sides of the planks are facing inside (this gives the bats something to grip onto), screw together the sides, inner slats, and roof.

Note: There is no bottom! This prevents competition from other animals.

3. Find a place for your bat house. Ideally, it should sit in a southwestern sheltered location that receives full sun, as stable temperatures over 27°C are best for nursing and weaning the young. Access to water bodies is also desirable. Even if all of these conditions are not met, bats can still use the house as bachelor groups are more tolerant of varied conditions.



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Whenever you buy something, think what effect it will have on your grandchildren.

Egnath Esevaran. The compassionate universe. Nigiri Press, California

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Volume 5, Number 1, Spring 1995